HOW TO KEEP WELL

FLOYD M. CRANDALL

Morgan
With sincere regards
Floyd M. Crandall

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AN EXPLANATION OF MODERN METHODS OF PREVENTING DISEASE

BY

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To My Mother

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" We live in a small bright oasis of knowledge surrounded on all sides by a vast unexplored region of impregnable mystery. From age to age the strenuous labour of successive generations wins a small strip from the desert and pushes forward the boundaries of knowledge."—*Lord Salisbury.*

" Search the scriptures of human achievement and you cannot parallel in beneficence, Anesthesia, Sanitation with all that it includes, and Asepsis—a short half century's contribution toward the practical solution of the problems of human suffering, before regarded as eternal and insoluble."—*Doctor Osler.*

INTRODUCTION

How medicine has arisen from mysticism, supernaturalism, and superstition, and, having gradually emerged from the thraldom of astrology upon the one hand and theology upon the other, now stands forth in the foremost rank of the sciences—

Why it is worthy of acceptance rather than the crude systems of quackery and pseudo-science which one after another arise only to sink into obscurity—

To set forth our knowledge regarding the prevention of disease and to show what advances have been made in recent years in our ability to prolong life and to prevent suffering, disease and death—

These things I have endeavoured to tell in language that all can understand and may thus profit by the knowledge accumulated during long years of patient toil by medical workers in the laboratory, the post-mortem room, and the hospital.

In very ancient times, medical practice was in the hands of the priesthood, and medical science

was closely interwoven with mythology. Having partially thrown off the shackles of such slavery, it began to develop a true science. But as the Dark Ages cast their shadow over mankind, with other sciences it sunk under the malign influences of bigotry and superstition. Astrology, alchemy, and magic were largely relied upon by the theologian-physicians of medieval times.

With the dawn of the Renaissance, medicine was one of the first sciences to exhibit signs of renewed life. Slowly but surely it threw off the stupor engendered by the murky air of the supernatural. Taking advantage of every discovery made by its sister sciences, anatomy, physiology, chemistry, and microscopy, applied medicine has steadily gone forward, at first slowly and falteringly, step by step; but gaining strength with every forward step, the progress during the last half century has been by leaps and bounds.

It is the progress of these later years which I wish especially to describe, and at the same time to explain the methods of preventing disease which the non-professional may profitably know. The trend of modern medical research is largely in the direction of prevention, and great progress has been made. The medical man is almost alone among the world's workers in deliberately cutting the

ground from beneath his own feet, and is striving to make discoveries which will reduce his own income. While much in the way of public hygiene may be done by the State and municipality to prevent disease, equally important measures of prevention rest with the individual. To a certain extent, each individual has his health in his own keeping, and can do much to preserve or destroy it. Much of the illness and suffering of the world results from ignorance. Notwithstanding the light of modern knowledge, in medical matters many of the people are as they who walk in slippery ways of darkness, and they often fall therein.

Surprise is frequently expressed that in this age of universal education quackery so largely flourishes, and so many educated people are led astray by theories of disease and treatment worthy of the Dark Ages. The reason is clear. Although popular education covers almost every other subject, it does not include medicine. We frequently, therefore, see those of broad culture, great wisdom, and extensive learning in other subjects, holding with childlike credulity the most absurd theories regarding the workings of their own bodies and the nature of disease. Great knowledge upon one subject does not preclude dense ignorance upon another. The room closed to the light is in dark-

ness though the rest of the house be filled with sunshine. Much light, it must be acknowledged, is nowadays offered upon medical subjects, but, as it has been truly said, the quack usually holds the candle.

The medical profession is to a certain extent to be blamed for this state of affairs. It has so frowned upon the public discussion of medical subjects by its own members that the people are ignorant of the great and beneficent work it is doing. To the charlatan and the pretender has been relegated the duty of giving popular instruction upon matters medical. In earlier times it was, no doubt, a wise policy to discourage too much public discourse by medical practitioners. The temptation offered to the unscrupulous to exploit themselves is certainly great. The times, however, have changed. The modern newspaper will not cease to publish articles upon medical subjects; the charlatan will boast, and the quack will advertise himself. These pretenders, one and all, not only exalt themselves, but by every means in their power decry legitimate medicine and its conscientious practitioners.

As a result of this policy of the medical profession there is much popular misapprehension. On the one hand is extravagant faith in the ability of

physicians and surgeons to do miracles, and on the other skepticism or actual disbelief in their ability to accomplish anything. The one state of mind usually results from the other, when medical men fail to accomplish the impossible. The following words of Dr. Andrew H. Smith are very pertinent, and are taken from his recent anniversary discourse before the New York Academy of Medicine: "The world has a right to know, and it is our duty to tell, just what progress we are making day by day, the steps by which results are obtained, the difficulties we meet, the uncertainties still to be cleared up, the problems which are pressing for solution."

It is here that we find one of the causes for the present widespread tendency to accept strange and absurd theories regarding disease and its cure. The medical man has not publicly boasted of his successes, but has hidden his candle under a bushel. Both the teacher and the believer in the many systems of pseudo-medical science, however, are prolific in discussion, both private and public. Every success is talked about and widely heralded. Not content with a modest candle, they set an electric light on a staff and maintain that they light the world.

The time has come when the medical man

should speak, not in his own defense, but in defense of the people, who are easily misled to their own hurt. He should do this, not by argument or vituperation, but by a calm statement of facts which shall set forth what legitimate medicine has done, not alone to alleviate suffering and disease, but to prevent its occurrence. This task I have attempted in part to perform, and have kept, I believe, strictly within the pale of medical ethics, which are nothing more or less than the application to medicine of the code of honour of gentlemen the world over.

By explaining causes I have attempted to show to the intelligent reader the reasons for the methods of prevention proposed, and why different measures are required for each disease. The cause being known, preventive measures in many instances become self-evident, and in all cases can be more intelligently carried out than they could be by a blind following of unexplained rules. This is the method of all modern scientific research, which seeks to discover causes and from them to deduce rational methods of prevention and cure. I have thus endeavoured to render my readers intelligent upon subjects regarding which most people, even the educated, are now ignorant.

If it be asked whether a little knowledge be not a

dangerous thing, we may reply with the question of the wise man, "Who, then, is out of danger?" The practitioner who has sometimes seen a little knowledge prove dangerous has far more frequently seen ignorance prove disastrous and even fatal.

HOW TO KEEP WELL

CHAPTER I

Modern Medicine

The medicine of to-day is not altogether modern, nor is it a science of past centuries. Much that is true and always will be true has come to us from the past, even the ancient past, and we of the present generation have added vastly to the store of knowledge. From a restricted calling, medicine has developed into a great profession, and has entered upon a before unknown stage of existence. There is no other calling that requires so extensive a technical education to insure the highest success. Taking the State of New York as affording the best standard in this country for medical education, the would-be medical student must be a graduate from a literary college or he must have an extensive preliminary education before he can enter the medical college. Here four years of study are required, after which he receives a diploma conferring the degree of Doctor of Medicine. This diploma, however, is not, as it formerly was, a license to practise. To

secure this license he must pass an examination before a State board of medical examiners. Having passed this ordeal successfully, the young medical man is permitted to enter practice, but the more ambitious are not content without hospital training. This requires two years longer.

Young Lydgate is now about twenty-eight years old and has probably never earned a dollar. If he entered college at eighteen, he graduated at twenty-two and left the medical college at twenty-six. At twenty-eight, therefore, he starts in life as a "young doctor," six years after his chum of the literary college has started upon his business career. Unless it be through some particular good chance, he is fortunate, if he settles in a large city, if he is able to support himself well in five years. The young man ambitious to make a fortune should certainly not adopt medicine as a career. In any case, he should be possessed of some financial means and a very large stock of pluck and endurance.

The modern doctor is made as well as born, thus differing from the poet and the successful man in many other callings. Natural ability, special aptitude, and love of the work are essential to success. The time is past, however, when they alone can assure permanent success in

medicine. There is no genius living who can succeed in that profession to-day without prolonged and extensive education. He must supplement this education, moreover, by continuous work and never-ending study. The modern successful physician is the product of the literary college and the medical school, the laboratory and the post-mortem room, the hospital and the dispensary. No quack relying on real or supposed natural gifts, no seventh son of a seventh son, no charlatan proclaiming that he has found the secret of life and the infallible cure of all disease, succeeds permanently to-day. These pretenders often make their entrance with a flourish, play their little parts, and sink out of the public notice. There is but one road to medical success, and that is the long, weary road of labour and toil, and only the few endowed with special strength of mind and body attain to the highest places.

The subjects now going to make medical knowledge are far more numerous, as well as more intricate, than they were even a few decades ago. Anatomy is the basis of all rational medicine. One of the chief reasons for the slow progress of medicine in earlier times was ignorance of anatomy, for until very recently dissection was looked upon as a desecration of the body. Even with anatomy

established as an almost finished science, it can be learned only by dissection, and each student must learn it for himself. Of but little less importance than anatomy is physiology, which describes the functions of the various organs. Chemistry is next in importance among the fundamental studies of the physician. The statement was recently made by a practitioner of one of the new medical sects that chemistry was unnecessary in their course of study because they used no drugs. This was a glaring acknowledgment of ignorance. One of the most marked characteristics of the quack is his ignorance of anatomy, physiology, and chemistry. A knowledge of chemistry is necessary to an understanding of almost every organ of the body. The digestive and excretory organs in particular are chemical laboratories whose actions can only be understood by the light of chemistry. Moreover, the examinations of the excretions and secretions, so necessary to the diagnosis of many diseases, are absolutely dependent upon chemical knowledge. Physiological chemistry is, therefore, one of the necessary branches of medical study. It is a field in which some of the most brilliant discoveries of recent times have been made. Histology, or minute anatomy, is the study of the tissues of the various

organs, and requires the microscope for most of its work. Pathology is the science of disease. The work of the pathologist is performed in the post-mortem room and the laboratory. In the latter place it consists chiefly of the microscopic study of the diseased tissues. While histology deals with normal tissues, pathology deals with them in their diseased forms. It is a science of vast proportions, involving, as it does, the many diseased conditions of each of the myriad organs and tissues of the body. Bacteriology is another science of vast proportions and great importance, and is destined to become more important and more vast with passing years. Materia medica describes the various elements employed in the treatment of disease, and deals largely with drugs. It is closely associated with pharmacy and pharmaceutic chemistry. Therapeutics is the science of the application of remedies to disease. It includes not only drugs, but the use of such elements as electricity, water, heat, cold, exercise, massage, diet, and a score of other measures. It is difficult for the medical man educated in the use of these various means of cure, each of which has its uses and limitations and special advantages in special cases, to comprehend the unwisdom of those faddists who deliberately select one as the

only means of treatment and throw all the rest away. All this is preliminary to what may be considered the practical subjects—practice of medicine, obstetrics, and surgery, with the eighteen or twenty specialties into which they are divided. It is clear that the task before the young medical man is not small.

A new and peculiar feature in modern medical science is the attention given to post-graduate study. Numerous schools have been established during the past twenty years in which medical practitioners may get out new editions of themselves, as one may say. Medical books become obsolete, and after a few years drop behind the times, and new editions must be issued. So it is with medical men. It is easy to get behind the times, particularly for practitioners away from medical centres. Reading will do much to prevent this, but there are many things that cannot be readily learned from journals and books. These schools are designed, therefore, to give instruction to practitioners, and the attendance at them is larger year by year. Their influence in raising the standard of practice throughout the country has been very apparent.

A marked feature of modern medicine is its cosmopolitan character. It knows neither nation-

ality nor language. The work of the medical scientist belongs to the medical men of all countries. The prominent medical journals of every language have a world-wide circulation. An important feature of every journal is its "abstract" department, in which is given the pith of all important articles appearing in the medical journals of the world. Those written in foreign languages are translated, so that the studious physician is informed each week of every addition to medical knowledge. He is not dependent for such information upon the imperfect and often sensational reports found in the newspapers. Of all men, the well-read physician of to-day can most truly say with John Bright, "My country is the world, my countrymen all mankind."

The system of trained nursing has had its influence upon the practice of medicine, in rendering it more exact. The trained nurse is a trained observer, by whose aid the attending physician can obtain an understanding of an intricate case he could not otherwise gain. The presence of such an observer adds also to the safety of the patient as the case progresses. This training of the power to observe is one of the reasons for the prolonged course of education required of the nurse. The details of handling and managing the patient

and administering treatment could be learned in shorter time, but training of the observation is a slower process. Notwithstanding the unpleasant experiences of some families with indiscreet nurses, the trained nurse is a potent factor for good in our modern life.

One of the notable peculiarities of modern medicine is the tendency to specialism. In this, however, it does not differ from other sciences. One sees much misapprehension regarding the true nature of medical specialism. There are some who suppose that a specialist is possessed of some secret knowledge not known to the profession at large. They seem to think that this knowledge is transmitted to the few who are favoured by admission to the specialty as the Asclepiadæ of old transmitted their knowledge to their descendants and followers. There could be no greater error. Specialists are continually writing articles descriptive of their work in journals open to all practitioners, and are discussing their theories and methods openly in societies. The only reason the general practitioner is not as well versed in every detail of each of these specialties is simply the fact that no human intellect can acquire and retain all the knowledge. The specialist is a man who, by devoting his whole energy to a limited

number of diseases, acquires an especially intimate knowledge of them and becomes especially skilful in their treatment. Most successful specialists were general practitioners in their earlier years. As their practice increased in some chosen direction they curtailed it in others, and were finally known as experts or specialists.

It is clear that there must be some good underlying reasons or specialism would not have assumed the proportions it has. The chief of these reasons is that the science of medicine has become so vast that no man can attain to it all. The work of the specialist is usually more satisfactory to himself than is that of the general practitioner, and is done with less mental exertion. In seeing large numbers of the same class of cases, those that are rare and trying to the general practitioner are to him familiar and common. By doing the same thing many times he gains the satisfaction of doing it particularly well. To specialism is due in large measure the development of modern medicine and surgery. It has been the specialist, working along certain restricted lines, who has gone ahead of his fellows and discovered the great truths which have made medicine what it is to-day.

There are, on the other hand, certain drawbacks

to the system of specialism. They are not so serious, however, that well-balanced men suffer materially from them. One of the most important of these drawbacks is the tendency of the specialist to magnify the importance of the diseases of which he sees so much, and to belittle other causes of ill-health. It is no doubt true that there is a tendency in specialism to narrow the field of vision, and to sometimes lead the practitioner to overlook important causes of disease. These criticisms are especially true of those who begin special practice immediately upon graduation, without the broadening influence of hospital training or general practice. There are large numbers of specialists, however, to whom such criticisms can by no means be applied.

Notwithstanding the great advantages of specialism and the important position it has obtained, the general practitioner will continue to be a most important element in the medical profession. His position, however, becomes each year more difficult. With increasing knowledge his responsibilities become greater, and more is expected of him. It is not necessary that he should be a great anatomist, physiologist, chemist, pathologist, and bacteriologist. He must, however, have a sound knowledge of all those subjects,

and must be in touch with the work that is being done in all branches and be able to make a practical application of constantly increasing knowledge. The general practitioner in the capacity of family physician has many duties to perform outside of the direct management of the sick and the prescribing of treatment. He is to a certain extent the keeper of the family health, and is frequently consulted upon the most diverse subjects. To him the family look for advice in trying emergencies, and often turn to him as a true man of the world in many affairs not purely medical. In the more strictly medical matters the trusted family physician is the one who must give the final opinion in many cases, even when the advice of the specialist has been sought, for he is looked upon as the special guardian of the interests of the patient.

To those who would say that, as medicine is becoming so broad a science, all diseases should be treated by specialists, a few thoughts may convince them that this is an extreme conclusion. The specialist must be more or less a stranger, for if such a system were adopted the patient might be under the care of half a dozen physicians in as many months. The family physician, who knows the family, its peculiarities and hereditary tendencies; who knows the patient, his idiosyncrasies

and past history; who considers every aspect of the case, will frequently reach a correct conclusion where a man with knowledge of a single class of diseases will err. If he be a wise man, and seeks special advice when special conditions arise, the patient's interests will be much better served than they would by a division of attendance. Moreover, the family physician has a greater feeling of personal responsibility, and this is one of the most certain guarantees of the patient's safety.

A word may be said regarding the choosing of a specialist. It should be done by the family physician, or at least by a general practitioner. There are differences, personal and professional, in the specialists practising the same specialty, and no one can know so well as the attending physician who will be best adapted to the particular case in hand. If the patient fears that the attending physician will select a consultant who will simply approve the treatment that has been given, and support the doctor, right or wrong, then he had better discharge that physician and get one he can trust. Some strange errors are made in the selection of specialists by patients. They frequently fall into most incompetent hands, and sometimes into those of unscrupulous men,

who have no special knowledge whatever of the specialty they are supposed to practise.

The principles upon which the family physician is to be selected are quite different from those which should guide in selecting a consultant. Some excellent advice was given many years ago by Oliver Wendell Holmes, and was as follows:

"Choose a man who is personally agreeable, for a daily visit from an intelligent, amiable, pleasant, sympathetic person will cost you no more than one from a sloven or a boor, and his presence will do more for you than any prescription that the other will order.

"Let him be a man of recognized good sense in other matters, and the chance is that he will be sensible as a practitioner.

"Let him be a man who stands well with his professional brethren, whom they approve as honest, able, courteous.

"Let him be one whose patients are willing to die in his hands, not one whom they go to for trifles, and leave as soon as they are in danger, and who can say, therefore, that he never loses a patient."

To this excellent advice something further may be added, for there are some requirements which

to-day seem more important than they would have seemed thirty years ago:

Let your physician be a clean man, physically and morally. Cleanliness is now justly regarded as an absolute requisite to success, in both surgical and medical practice. Surgical cleanliness is, in fact, the cleanest cleanliness that has ever been known. Beware of the doctor, therefore, with unclean hands and soiled clothes. They are bad signs. If careless in matters so apparent as this, he will probably be careless in matters that are not apparent. You cannot expect perfect asepsis or antisepsis from a dirty doctor. In no other person is there greater need of these biblical qualities—clean hands and a pure heart.

Let him be a man of character in all to which that term applies. Remember that he must come more intimately into your family than does any other outside person. To him you must sometimes entrust secrets known to no other living soul. You must admit him to every closet to inspect all your family skeletons. Only to a man of true character should be entrusted the many things which you must perforce entrust to your physician. He should be a man of such magnanimity and largeness of character as to hold inviolable your confidences, even though

you drop him and tell your friends you would not entrust him with the health of your dog, and do otherwise despitefully use him.

Let him be a tactful and discreet man. Though he have eyes to see and ears to hear, he should see and hear only those things which you wish. If he should, however, hear or see more, he should be sufficiently discreet not to talk to you about it.

Let him not be a man of extreme and peculiar ideas, or one who practises by weird or singular methods. Avoid a man with a hobby; he will ride it roughshod sometime over your aching bones. Remember that there is nothing to prevent a doctor who assumes the title of physician only, without attaching to it the name of any school or dogma, from selecting in your treatment anything that he believes will benefit you. Men who ostentatiously adopt peculiar modes of treatment, and resort to extraordinary methods, are rarely well balanced. Their judgment is often at fault. You will be safer with an old-style, plodding doctor than with one of these modern faddists, who will experiment upon you with extreme measures and untried methods.

Let your selection not be made simply because a doctor is "smart." The so-called brilliant man is often reckless, and prone to take desperate

chances when desperate chances are not required. He is theatrical, and thinks more of exploiting himself than he does of the good of his patient. Do not reject him simply because he is brilliant, but make certain that his brilliancy is tempered by judgment and that there is a well-grounded character behind it. No matter how brilliant he may be, if he be intemperate, immoral, unscrupulous, rash, his patients will suffer. "Genius and character are bound together by indissoluble ties; genius without character is like oil that blazes up and dies down about a shattered lamp."

When it is possible, then, let your physician be a man of character—intelligent, educated, tactful, clean—a gentleman who stands well with his professional brethren and has an honourable record.

Having found such a man, hold to him, and do not cast him aside for every passing fancy or because of minor shortcomings. You will not find perfection in all things. After a few years of attendance, a physician, if he be judicious and well read, acquires a knowledge of you and your family which will result largely to your benefit. If you change your physician with every illness, or for every passing whim, or because some friend advises a better one, you will certainly be one

of those who have lost their confidence in medical men and are skeptical about the efficacy of treatment. You will, indeed, find it difficult to obtain a good physician, for competent men with good practice shun those who are ever changing their doctors, for they know by experience that they are double-minded, and unstable in all their ways, and very undesirable patients.

CHAPTER II

The Causes of Disease

The cause of disease has ever been a fruitful subject for speculation. The first to promulgate a theory in any degree rational was Hippocrates, who was born 460 B. C. and is known as the Father of Medicine. He was both physician and philosopher. It was the custom of that age to divide into sects or schools in all questions of science, philosophy, and ethics. The two most prominent medical sects of the Greeks were the dogmatic and the empiric. They are still of interest, as they outline fundamental principles which are dominant in the medicine of to-day.

The dogmatic sect was founded by Hippocrates and in its general philosophy was closely allied to the school of Pythagoras. A conclusion reached by reasoning was of paramount value, although the determining of the causes of phenomena was held to be of great importance. Symptoms were not regarded as all-important, but the action of the organs from which the symptoms were derived

was studied. This doctrine has come down to us through all the centuries and has been the mainspring of modern scientific medicine. Notwithstanding its imperfections, which were due in part to lack of knowledge of anatomy, physiology, and chemistry, it was the most complete and rational theory promulgated in ancient times. "Like everything else that is good and durable in this world, modern medicine is a product of the Greek intellect."

It was the teaching of the empirical school that the cause of disease could never be determined, and that symptoms alone constituted the natural history of an illness and were the only true guides for the selection of treatment. Remedies were discovered by experiment; anatomy and physiology were regarded as useless. It was a school of pure deduction. Theories were evolved out of the inner consciousness with complete disregard for anatomy and pathology. The one point of wisdom shown by this sect was the value placed upon experience, but it erred in deriving its experience from superficial observation, which is often very misleading. The most prominent exponent of the empirical school in modern times was Hahnemann, the founder of homeopathy, who adopted the theory that symptoms alone constitute

the only guide for treatment, and ridiculed the idea that the cause of disease could be determined. Had the medical profession sat calmly down and said that the cause of disease could never be discovered, medical science would now be where it was a hundred years ago. Empirical medicine has had little share in promoting the achievements of the past fifty years and in aiding the advancement of preventive medicine.

Other sects, based upon special theories of disease, have risen from age to age, but have disintegrated and passed away, though the faint imprints of some may be seen to the present day. When founded upon some real scientific truth, the truth lives after the sect is dead, as the spirit survives the body. These truths one after another have become incorporated into the great mass of medical knowledge, while the sects built up around them have been forgotten. This has been the fate sooner or later of all sects and schools founded upon single dogmas. The medical profession is not founded upon any one theory of disease or dogma of practice, but adopts everything which, when weighed in the balance, is found not wanting. Its practitioners may honestly select anything from the whole field of medicine. They are not restricted by any single theory or system or motto

of practice. A diploma which confers the title of Doctor of Medicine confers the legal and moral right to employ any known means for the diagnosis and treatment of disease.

During the medieval ages the authority of Galen was supreme in medicine. His teaching was based upon that of Hippocrates. There is nothing in history to compare with the influence which Galen held in matters medical except the influence of Ptolemy in matters astronomical. Both lived at about the same time, and the systems promulgated by each were regarded with almost the reverence accorded to the Scriptures. In fact, the expression of opinions different from those taught by these two men was punished by the Church. After the death of Galen, about 200 A. D., for thirteen centuries medical science, like every other science, was stagnant. Then began the age of restoration, when science in all its branches threw off the blighting influence of blind reliance upon the authority of one man. At the present day the opinions of certain scientific observers are held in high respect, but there is no such thing as a scientific or medical *authority* in the old sense. A man's theories are now accepted when he proves them to be true, not because he says they are true.

One of the most important events of modern medicine was the announcement of the theory of *cellular pathology* by Virchow in 1858. By this is meant that all vital processes issue from cells. Vital force is a name given to that essence of life whose nature we do not yet understand and perhaps never will. By the older theory it was supposed to be distributed through the body or located in the organs as a whole. By Virchow's theory the animal body is regarded as an aggregation of cells, each of which has a unity and life of its own. As a nation is a unit composed of individuals, each having his own personality, living his own life, and performing his own part in the work of the whole, so living bodies are composed of individual cells in which the vital force resides. By this theory the understanding of disease has been enormously advanced. At first proposed as an hypothesis, it has been accepted by the scientific world, and is the basis of all modern medical thought.

The discovery of the bacteriological origin of certain diseases is a chapter by itself. It was not an accident, nor was it a single discovery by a single observer. It was the last link of a long chain. Not one link could have been omitted, and it does not seem possible that the different discov-

eries in the series could have been made much sooner than they were. Each discovery led to the next and each was dependent upon what had gone before. Soon after the invention of the microscope in the latter part of the sixteenth century, some of the larger bacteria were seen, but their true character was not then suspected. Successive improvements of the microscope were marked by successive discoveries in bacteriology.

Were one to write a history of bacteriology, he would be obliged, also, to almost write the biography of Pasteur, so closely is he associated with all the earlier work in that science. In 1863 he published his first great work, which established the fact that fermentation and putrefaction are due to micro-organisms. The theories he then promulgated, and which are now universally accepted, were revolutionary in the extreme. This work was the foundation of the present germ theory of disease. It was the inspiration of all the bacteriological work which has since been done, and gave the death blow to the old theory of spontaneous generation. Pasteur was a patient and untiring observer and collector of facts. This is an important qualification of a scientist, but alone is of but little value. He possessed in addition to this the power, amounting to genius, of generaliza-

tion and drawing correct conclusions from the facts he observed. No other man has excelled him in this, except possibly Darwin. He was never in a hurry to publish a result until its truth had been absolutely proved.

Unlike many laboratory workers, Pasteur was eminently practical, and his researches have already resulted in incalculable benefit to the human race. A single example will illustrate this. In 1865 the silk industry of France produced a revenue of 130,000,000 francs. Owing to a disease in the silk worm, it fell in a few years to 8,000,000 francs, and the industry was threatened with annihilation. Pasteur was appealed to and undertook the study of this disease. Abandoning his cherished work, he entered with all his strength into its study, and after long research discovered that the disease was due to a micro-organism which affected the worm, the moth, and the egg. He suggested a remedy, and after a short time the silk industry of France was restored to its original prosperity. A few years later the wine industry of France was threatened with ruin, owing to an unexplained fermentation in the wine. This was investigated by Pasteur, the cause was discovered, and the industry was saved. Important as this work was in its immediate results, the remote results

were more important, for it gave him an insight into the genesis of infectious diseases.

Pasteur's results were largely secured by animal experimentation. It was natural, therefore, that he should first study the infectious diseases from which animals suffer. He thus studied and traced to their cause splenic fever, fowl cholera, swine fever, and hydrophobia. He discovered many facts regarding suppuration and the infection of wounds. His whole method of work being that of actual experimentation, chiefly with animals, he did not discover any of the germs of diseases affecting the human race, but his work established the germ theory of disease more thoroughly than it could have done had it been limited to the human subject.

The earlier work of Pasteur was supplemented by that of many expert observers, one of the most notable being Professor Tyndall, who carried out extensive studies upon living germs in the air. He demonstrated the presence of bacterial clouds which are blown hither and thither by the wind, so that it is impossible to expose a culture medium even in the open country without taking up quantities of living germs. The greatest student of the germs which produce disease in the human body is Koch, of Berlin. Being a younger man than

Pasteur, and following him in his discoveries, he has done more than any one else to devise methods of cultivating germs artificially and isolating each species so that they may be studied in "pure cultures." He discovered the bacterium of tuberculosis in March, 1884, and the bacterium of cholera not long after.

For several years the subject of bacteriology was in a chaotic state, and every discovery was looked upon with distrust by the conservative portion of the medical profession, who would accept no statement until proved. Gradually, by the most laborious effort, one landmark after another was established, and fact after fact was proved, until to-day no intelligent physician questions the importance of bacteria in the causation of a large number of diseases. A portion of a vast field has been surveyed, but no one can tell how much lies beyond or what the future may reveal.

The error should not be made of thinking that all disease is caused by bacteria. There are numerous other causes, some originating outside of the body and others within it. Those originating without the body are substances of an irritating or poisonous nature capable of causing abnormal local or constitutional conditions. Among these

are materials used in certain trades, like arsenic and mercury, or certain drugs like opium and alcohol, or poisonous plants. Those originating within the body are the products of the perverted action of certain organs, or the absorption of normal injurious products which are not properly excreted. There are many diseases of this class. Disease may also result from certain mechanical causes, as excessive heat, cold, moisture, or dryness, or from physical injury.

Diseases do not result from a single cause, and they cannot be cured by any single method of treatment. The philosopher's stone and the fountain of youth still lie concealed in some undiscovered country. When they are found we may reasonably seek the panacea for all human ills.

CHAPTER III

BACTERIA

BACTERIA play a rôle of vast importance in the economy of nature. Most species, of which there are unnumbered thousands, are the benefactors rather than the enemies of mankind. They are the scavengers of nature, whose office it is to remove dead organic matter and convert it into simple and harmless chemical compounds. All fermentation, decomposition, putrefaction, and decay are caused by bacteria or their near relatives, the yeasts and moulds. It is largely by the action of bacteria that the upper layers of the soil are transformed into fertile land fit for the production of crops. Numerous processes of animal and vegetable life are wholly, or in large part, dependent upon bacterial action. Notwithstanding the fact that some bacteria are among the greatest enemies of man, were all species to be destroyed he would lose more than he would gain. It is not, however, these harmless or benign bacteria which we are to consider in this place, but

rather the comparatively small number of disease-producing germs known as pathogenic bacteria.

Bacteria are often referred to as worms or bugs, and it is a common belief that they are minute animals. This is not the fact. They belong to the lowest order of plant life, being relatives of the fungi and moulds. They are mere cells, or specks of living matter, so minute that their examination taxes the utmost powers of the microscope. The micromillimeter, equivalent to about 1-25,000 of an inch, is taken as the unit of measurement. This means that 25,000 bacteria could lie side by side in the space of one inch. The smallest germs are about one-tenth of this unit in diameter. Under the microscope bacteria appear much like little periods, commas, or dashes. There is not a bacterium known which has a fierce or animal-like appearance, like that sometimes portrayed in patent medicine advertising. They are simply single-celled plants, and are usually classed with the fungi. They obtain their food by simple surface absorption.

Bacteria multiply by a process called fission. When it reaches a certain age, the bacterium elongates and a depression appears near the centre. This increases until the original germ is divided into two. Others divide irregularly in all direc-

tions and produce clusters of cells. Some germs also reproduce themselves by means of spores. A spore is a minute granule which forms within a germ, and has the power of developing a germ similar to the parent, as the seed produces a plant. These spores are extremely tenacious of life, and withstand drying and great extremes of heat and cold. Germs which multiply by spores are far more difficult to destroy, therefore, than those which do not. Some germs fissure every twenty minutes. If they do so but once an hour, a simple mathematical computation demonstrates that 16,777,216 germs may look back to a common ancestor who flourished in a bygone age twenty-four hours before, not to speak of the intervening generations that have perished. If such a germ be a producer of poison, it is not difficult to understand that disease may result from organisms which multiply at such a terrific rate.

In order that most varieties of bacteria may be seen and studied, improved and powerful microscopes are required, fitted with delicate and expensive appliances. Even with these, most germs must be stained and specially prepared before they can be studied. It has been found that the aniline dyes have a remarkable power of colouring bacteria. Each species has a selective power, and

is affected by certain dyes in a peculiar manner. Thus, under proper treatment each germ assumes its own peculiar appearance. This, even more than its shape and size, frequently aids in its recognition. The ability to isolate one species of bacteria from every other species, to cultivate it and to study its life history and growth, is one of the greatest triumphs of scientific research. For these results we are largely indebted to the genius of Robert Koch.

All germs require moisture for their development, with suitable temperature and pabulum. Light, as a rule, is not favourable to their growth. Cold arrests the growth of all micro-organisms, but the lowest degree attainable does not destroy the vitality of certain species. Heat, on the other hand, is a very potent germicide. All known pathogenic germs are killed by heat far below the boiling point.

Having learned to isolate a germ from the body and cultivate it, we are prepared to study its action in the causation of disease. Four postulates are formulated by Koch as being necessary to prove that a given bacterium is the cause of a certain disease. 1. It must be found in the tissues or secretions of an animal suffering from the disease. 2. It must be cultivated outside of the

body in an artificial medium, all other germs being excluded. 3. This culture must produce the same disease when inoculated into the body of a healthy animal, susceptible to the disease. 4. The same germ must then be found in the body of the animal so inoculated. These four requirements have been fulfilled in many diseases. A few are believed to be due to certain germs, although all the requirements have not yet been fulfilled. Typhoid fever, for example, does not occur in any animal. The evidence, however, is so convincing that it is due to a certain bacillus, that that bacillus is accepted as the cause, although it has been impossible to take all the steps proposed by Koch.

The relation of these microscopic bodies to a given disease being found, the question arises: How do they produce this result? The bacteria themselves have but little effect; they act chiefly by the production of poisonous principles known as toxins. By a subtle chemistry they decompose the elements by which they are surrounded to form new compounds. Some of these are poisonous and produce the phenomena known as disease; by far the greater number are harmless. There is nothing peculiar in this action. Every living cell appropriates certain elements for its

nutrition and excretes certain other elements, and bacteria cells form no exception to this rule. If these products of excretion are harmless to the animal body the germ is benign. If they are poisonous the germ is known as pathogenic. The growth of many of the higher orders of plants results in similar chemical changes, as seen in the action of yeast in the process of bread-making and of brewing.

Various micro-organisms act as ferments. One produces lactic acid from milk, another acetic acid from alcohol. Putrefaction is the result of the action of certain germs upon albuminous material, the product being of offensive odour. Some substances, like milk, are subject to various forms of fermentation, for some germs act upon the milk sugar and others upon the casein. By fermentation is meant the decomposition of special compounds of the starch and sugar class. Numerous phenomena of nature are also caused by the action of bacteria. The phosphorescence which sometimes results from decaying vegetable and animal matter is directly due to them. Certain germs cause a greenish or bluish florescence, which gives colour to some bodies of water. The miracle of the "bleeding host," in which bread becomes covered with a red substance like blood, is also

the result of such action. The red substance consists of masses of the germ known as the *bacillus prodigiosus*.

The poisons produced by pathogenic germs are known as toxins. They are of two classes. Those of the simple class are capable of causing fever and inflammation. The others, known as toxalbumins, are among the most intensely poisonous substances known. Many of these toxins have been so far isolated that their action could be partially studied. Some of them are of almost inconceivable virulence, being many hundred times more poisonous than morphine or strychnine. They are so active, in fact, that it is now believed that some of them are of the nature of ferments. It is the continuous formation of these toxins which produces those results known as infectious diseases. Such diseases are, therefore, nothing more nor less than conditions of acute poisoning.

Certain substances formed by the action of bacteria upon nitrogenous matter are known as ptomaines. These ptomaines are mostly active poisons, and may be formed outside the body. Certain germs acting upon milk develop a virulent ptomaine known as tyrotoxicon. This is the cause of ice-cream poisoning so frequently reported during the summer months. It results from

improper care of milk from which the cream is made. The symptoms simulate those of arsenic poisoning. The summer diarrheas of children, which destroy so many infant lives, are largely the result of ptomaines formed in the milk upon which they are fed. There are poisonous substances sometimes formed within the body itself, known as leucomaines, which result in a sort of self-poisoning or auto-infection.

Bacteria are classified according to their forms and appearance, the most common being bacilli, spirilli, and cocci. A bacillus is a rod-shaped germ having rounded or pointed ends. A spirillum is a long, twisted germ, sometimes having a very regular spiral form. A micrococcus is a spherical body, and appears as a mere dot. Micrococci are classified according to their groupings as follows: staphylococci, which grow in clusters like grapes; streptococci, which grow in chains like strings of beads; diplococci, which grow in pairs; and sarcinæ, which form cube-shaped groups. Each germ has its own individual name, usually a long one. For example, the little body concerned in the formation of pus glories in the title *staphylococcus pyogenes aureus*.

Bacteria are also classified according to their habits of life, as saprophytes and parasites. The

first develops independently of a living host, usually in decaying vegetable or animal material. The second develops only in the living body. A facultative saprophyte develops in both living and dead animal tissue. Such germs are particularly hard to combat. If deposited in a favourable place outside the body, they may reproduce themselves indefinitely, and thus infect a constantly increasing area and retain their vitality for an unlimited time. All disease-producing germs are either strict parasites or facultative parasites. The saprophytes make up the great mass of germs beneficial to man. The most of them do not generate poisons. A few, however, do this, but do not produce disease, as do the parasites. The poisons are formed outside the body, but may be taken into the body like any other poison. Some of the putrefactive bacteria are germs of this class.

The term "blood poisoning" is a popular expression used to cover a variety of conditions. It may mean toxemia, the absorption of the poisonous products of germs from a local point of infection, no germs being found in the blood or tissues. It is sometimes used also to mean septicemia, which is not alone the absorption of toxines, but the invasion of the system by bacteria. It is sometimes used, also, to indicate the absorption of

leucomaines—poisoning elements formed within the body itself. It is even used sometimes to denote the poisoning of the body by ptomaines. It is thus seen that the term as popularly used is a very indefinite one.

It being granted that certain germs are the cause of a disease, does it necessarily follow that every person exposed to those germs will contract the disease? By no means. Germs are in their essential qualities seeds, and seeds require a soil for their growth. If they fall by the wayside they take no root. Upon stony ground forthwith they spring up, but wither away; among thorns they are choked. Only upon good ground will seeds or germs bring forth fruit. As each seed requires a peculiar soil for its fullest development, each according to its kind, so germs require peculiar conditions for their growth. The physician recognizes, therefore, two causes of disease, predisposing and exciting—the soil and the seed. The germs of diphtheria lodge in the throat of a healthy adult. The seeds fall by the wayside and take no root. Other germs lodge in the throat of a child who has been immunized by antitoxin. The seeds have fallen among thorns, and the thorns spring up and choke them. Other germs lodge in the throat of a child with sound and

healthy mucous membranes. The seeds fall upon stony places and forthwith they spring up but soon wither away. And still other germs lodge in the throat of a child with enlarged tonsils, adenoids, and chronic catarrh. The seeds fall upon good ground and grow luxuriously in a congenial soil.

Predisposing causes are important but often extremely obscure and difficult of detection. It has been proved that animals which have not taken a disease when inoculated while in perfect health, have quickly succumbed after a prolonged fast or when exhausted by excessive exercise. There is truth in the common belief that a contagious disease is more readily contracted "on an empty stomach" or when the power of resistance is lessened by fatigue. Heredity is often an important predisposing cause, but very few diseases are actually inherited. Hereditary influence consists of peculiar conditions of the body tissues which render them especially susceptible to the assaults of germs. The soil may be rich, but there is no vegetation without seeds; the hereditary tendency may be strong, but there is no infectious disease without germs.

The older theory that the infectious diseases may sometimes occur through spontaneous generation is absolutely untenable. The source from

which the bacilli are derived in sporadic cases is often obscure. It is as absurd to suppose, however, that a distinct variety of bacillus can generate itself from nothing, as to expect that a plant will grow in one's garden without seed or planting. If a strange weed or flowering plant does appear, we conclude that some stray seed has been dropped unknown to us. And so sporadic cases of disease develop here and there, but whence they come we may oftentimes never know. There being no spontaneous generation of infectious diseases, there can be no "filth diseases" in the old sense of the term. No extreme of filth can cause a specific infectious disease without implanting in the filth the germ of that disease.

The body has not been left entirely unprotected and wholly at the mercy of pathogenic germs. It has remarkable powers of resistance, differing with different individuals. The acid secretions of the stomach kill some germs. Certain elements of the blood have to a marked degree the power of destroying others. Beyond a certain point this power ceases and disease results. Exposure does not necessarily mean infection.

Immunity from contagious diseases, though the subject of much investigation, is still an obscure one. Some species of animals are insusceptible

to germs which are very fatal to other species. Most sheep are very susceptible to anthrax, but Algerian sheep rarely if ever contract it. There is also a racial immunity which renders certain races almost immune to certain diseases. The Chinese show a marked immunity from cholera. The Jews show a most conspicuous immunity from tuberculosis and acute epidemic diseases. There is still further a personal tolerance which is very noticeable. The young of all animals are, as a rule, more susceptible to infectious diseases than are the old.

A subject of the greatest practical interest and one upon which a vast amount of labour has been expended, is that of acquired immunity. By this is meant the immunity which commonly follows an attack of a contagious disease. Closely allied to this is the immunity which we have recently learned to confer in a few diseases by the administration of antitoxin. Owing to the fact that it is so closely interwoven with physiological chemistry and with the whole fabric of bacteriology, it is a most difficult subject to elucidate in a popular manner. It will be discussed at greater length in the chapter on antitoxins. It is sufficient here to say, that after the toxin is generated by the bacteria, through some action either of the body

tissues or of the blood serum not yet positively determined, another element is gradually formed, antidotal to the toxin, and apparently destructive to the bacteria themselves. To this element has been given the name of antitoxin. Were it not for some such action, every infectious disease would be fatal. The bacteria would steadily multiply and produce a constantly increasing amount of toxin, and the time would necessarily come when no human organism could withstand its poisonous effects.

Increased knowledge regarding bacteria and their action in producing disease renders it more and more probable that but little is to be expected in the actual prevention and cure of the infectious diseases from any known chemical compound or antiseptic: They are either poisonous to the animal body, or are decomposed and rendered inert before they reach the germs at the seat of the disease. Hope seems to lie in our ability to obtain certain curative elements resulting from the action of the germs themselves. It is in this direction that the most active work is being done and from which the most important results are to be expected.

There are a few micro-organisms belonging to the animal kingdom that are capable of causing disease in man. The most notable of these are

the *plasmodium malariæ*, and certain ameba which are capable of causing dysentery. The plasmodium develops within the red blood cells and is an organism of extraordinary interest. It is easy of study, and its life history is well known. It will be described in detail under the subject of malaria.

The astronomer and bacteriologist work upon opposite sides of the great field of scientific research, the one with the telescope, the other with the microscope. Both use units of measurement almost incomprehensible to the human mind, one from its vastness, the other from its minuteness. The astronomer makes his calculations in thousands of miles, the bacteriologist in thousandths of an inch. The one studies worlds unseen by the natural eye, the other infinitesimal cells. The cells, however, are as real and tangible as are the worlds, and probably of more importance to us of this earth. They are numbered, not in scores or hundreds, but in millions. Comparisons are odious. But one can scarcely refrain from questioning whether, during the past quarter of a century, the work of any class of men has been more productive of good for mankind than has that of the patient toiler in the laboratory, with his microscope and staining fluids and his intimate association with virulent disease-producing germs.

CHAPTER IV

Infections and Contagions—Their Management and Control

"Vague fear is the mother of panic, and vague terms are the most potent generators of vague fears." In beginning the study of the infectious diseases it is highly desirable to understand clearly what is meant by the various terms now employed, for a misunderstanding of them will cause unnecessary fear and apprehension, and lead to the adoption of erroneous methods of management. Radical changes have occurred in the application of various terms during the past twenty years. The older nomenclature, in the light of present knowledge, leads to confusion and misunderstanding.

Diseases caused by micro-organisms are now known as infectious diseases, and the process by which they are transmitted is known as infection. The term refers to the cause of disease, and not to its mode of transmission. Hence, infection and contagion are not synonymous terms. Infectious

diseases may be either transmissible or non-transmissible. Not all diseases produced by germs can be transmitted from one individual to another.

Transmissible diseases originate from some animal body, and are conveyed either directly or indirectly to the person infected—that is, they may be contagious or non-contagious. By a contagious disease is meant one which is transmitted from an individual through the air or by direct contact. Scarlet fever and small-pox are examples of this class of disease. A non-contagious transmissible disease is one which is conveyed not by direct contact, but by some intermediate means of communication. An example of this is tuberculosis, which is not transmitted by contact, but by inhaling dust which contains tuberculous germs derived from dried and pulverized sputa of some consumptive person. The disease is thus transmitted from the first sufferer to the second by indirect means, and not by direct contact, and is therefore not contagious, although it is transmissible. A non-transmissible or miasmatic disease is one derived from some place or thing, and not from an individual. There is a rapidly growing doubt regarding the existence of any true miasmatic disease. These various forms of infectious disease

are shown more clearly by the accompanying table.

Infectious Diseases	Transmissible	Contagious.
		Non-Contagious.
	Non-Transmissible.	

The term septic disease is sometimes applied to those forms of infectious disease in which the bacteria gain their entrance into the body through a wound or abrasion of the skin or mucous membrane. Examples of this class are erysipelas, and various infections of surgical wounds. By the term "sepsis" is usually meant the infection of a surgical wound or an abraded surface. From this is derived the expression "antisepsis," which means the destroying of septic germs, and "antiseptic," which is a chemical element capable of destroying or checking the growth of germs. By "asepsis" is meant the prevention of sepsis, or, in other words, the exclusion of germs from wounds and abrasions.

Certain other terms are in frequent use, and should be understood. A disease is "epidemic" when it spreads rapidly and attacks many persons at the same time. A disease is "endemic" when it is constantly present in a place. For example, diphtheria is endemic in all large American cities, but occasionally becomes epidemic. Cholera is

endemic in India, but periodically extends beyond its habitat in epidemics. A "pandemic" is a very widespread epidemic. It is a term used to indicate that a disease has spread over a continent or has become world-wide, as did influenza in 1889.

The infectious diseases have certain features in common. There is a period between the exposure and the development of the first symptoms known as the period of incubation. During this time the bacteria which have entered the body are multiplying and acquiring strength sufficient for the production of symptoms. This period of incubation varies greatly in different diseases, and even in the same disease. The number of germs introduced, their varying activity, and the resisting power of the individual, all have their effect in determining the time when sufficient poison is generated to produce symptoms.

Many infectious diseases, particularly those of the contagious type, are self-limiting. They run a more or less definite course, and end in recovery within a certain definite time, if the patient has sufficient strength to combat them. They usually begin with a definite onset marked by decided and characteristic symptoms. Of these, a chill is the most common, but vomiting, nausea, headache,

malaise, and in young children convulsions, frequently occur. Very few diseases terminate by crisis. Pneumonia does this more commonly than does any other disease. Crisis consists in a rapid fall of temperature and beginning improvement. It is rarely theatrical. The "fever" of romance, in which the patient after a profound sleep awakes at an hour exactly foretold by the physician, who pronounces the danger past, is not seen in actual practice. Sudden changes for the better frequently occur, but can rarely be foretold with certainty. As a rule, recovery from the infectious diseases is gradual, and the serious symptoms do not all subside at a definite time. There is no critical day for each disease on which it can be said that the patient, having passed it, is out of danger. That momentous question must be decided for each patient according to the conditions, and not because he has passed a certain number of days. The medicine of the novel has but little in common with that of everyday practice.

In endeavouring to prevent the spread of the infectious diseases a knowledge of their natural history or the course which they naturally run is necessary. In dealing with the contagious diseases two periods must be taken into consideration, that of incubation and that of contagion.

Upon these are based the periods of quarantine and of isolation. The incubation period has already been defined as the time between exposure and the appearance of symptoms. The quarantine period is the time during which those who have been exposed to a disease should be isolated to prevent the exposure of others. It is equal, therefore, to the longest possible period of incubation. Quarantine may be either public or private. A child in quarantine for scarlet fever, for example, is not necessarily confined to a single room, but is prevented from mingling with other children who have not had the disease, until the period of incubation is passed. As the period of incubation is variable, the quarantine period must be placed at the longest possible or, at least, the longest probable time of incubation. Thus, if the period of incubation for scarlet fever varies from one day to seven days, the child should be quarantined for at least seven days.

The contagious period is the time during which the disease may be transmitted by the patient to others. It is, therefore, the time during which he should be isolated. These various periods of the more common diseases are shown in the accompanying table. It should be understood that

averages represent probabilities, while extremes indicate possibilities.

Disease	Incubation Period		Quarantine Period (days)	Isolation Period
	Avr'ge (days)	Extremes (days)		
Diphtheria	2	½ to 6	6	From earliest symptoms until germs have disappeared. Two weeks after membrane is gone.
Scarlet Fever	2	½ to 7	7	From appearance of rash till desquamation has ceased, usually six weeks.
Cholera	2	1 to 10	10	From onset till one week after the diarrhea has ceased.
Influenza	3	1 to 5	5	From onset to complete convalescence.
Typhus Fever	7	5 to 12	12	From onset to complete convalescence.
Typhoid Fever	12	8 to 18	18	From onset to two weeks after fever is gone, usually six weeks.
Measles	12	9 to 16	16	From first catarrhal symptoms to convalescence, twenty-four days.
Whooping-cough	12	7 to 16	16	From first catarrhal symptoms to cessation of cough, often three months.
Smallpox	12	9 to 16	16	From onset until last crust has fallen, usually six weeks.
German Measles	14	6 to 18	18	From two days before rash till symptoms are gone, often two weeks.
Chicken Pox	14	12 to 16	16	From onset until last crust has fallen, usually fourteen days.
Mumps	18	14 to 21	21	From one day before to ten days after swelling, usually three weeks.

The contagious diseases are spread more widely through failure to enforce isolation than by any other means. This may result from failure to recognize their presence, for sometimes they are insidious in their onset, notably diphtheria and typhoid fever. Others, like measles, are often

mistaken during the first few days for some other disease. Every doubtful or suspicious case should be isolated until its nature can be determined. Physicians are sometimes blamed for causing unnecessary alarm in expressing fears as to the nature of a disease. Reasonable people, however, do not object to such caution, and prefer the trouble caused by temporary isolation to the dangers and troubles which may result from the exposure of other children. It should not be forgotten that a mild case of any infectious disease in one individual is capable of causing the most virulent type in another.

The question of school attendance usually arises upon releasing a child from isolation. Schools are the most potent means of disseminating the infectious diseases. It is a serious matter to allow a child, regarding whom there is the slightest suspicion, to go to school. Illness and death may follow an error of this kind. The system of school inspection now in force in most of our larger cities cannot be too highly commended. Its value and importance are shown by the fact that on the first 65 days of inspection when the system was inaugurated in New York, the following cases of diseases were discovered: whooping-cough, 26; scarlet fever, 32; measles, 88; mumps, 117; diph-

theria, 167; contagious eye disease, 702; parasitic diseases of the head, 2,627. After the first few months, the diseases discovered were less numerous, showing that parents had learned that children sent to school ill would be sent home, and had become more careful. This latter result is one of the most important effects of school inspection. A potent means of disseminating contagious disease is the arrangement of the coat-rooms of many schools. The outer clothing of the children, some of whom may have come from families in which disease exists, is hung closely together, sometimes layer upon layer upon the same hook. The rooms are frequently small and ill-ventilated, and sometimes mere unlighted and overheated closets, where every facility is offered for the dissemination of bacteria. The coat-rooms of schools should be large and well ventilated, with room sufficient for hanging each child's clothes separately.

The advisability of closing schools in the event of a serious epidemic must be settled differently in different communities. In the country and in small towns, where the children will be separated from one another when at home, their closure may be an important measure of prevention. Moreover, in such a community illness in a family is at once known and contagion is guarded against.

In large cities, on the other hand, the conditions are quite different, particularly in the crowded tenement regions. Here the children cannot and will not be confined to their homes, but will mingle with one another all day long. Closing the schools will not prevent it. In addition to this, the daily inspection of the children in school is a great safeguard against the spread of disease.

The selection of the sick-room for contagious diseases is of much importance. In small houses and city flats there is but little choice. Where selection is possible, the room should be chosen which can be most readily isolated and will at the same time be convenient and habitable. Six weeks' confinement to a single room, as in scarlet fever, is a trying ordeal, and isolation during the last days of the period can be more strictly enforced if the room is cheerful and comfortable. While a room at the top of the house is for some reasons the most desirable, one on the floor below should be selected should there be no bathroom on the top floor. The passing to and fro to the bathroom will frequently undo all the other effects of isolation, not to speak of the additional labour involved. A most satisfactory arrangement is a back room on an upper floor opening into a bathroom, the latter having also a second door

into the hall. Two doors thus intervene between the hall and sick-room. By placing a small gas-stove in the bathroom much labour is saved and isolation can be made complete. When possible, two rooms or a whole floor should be utilized.

Cracks and keyholes of unused doors should be sealed with strips of paper as for fumigating. The hanging of dampened sheets before the door is a measure of some practical value. It is not to be supposed that they can disinfect the air or destroy the germs, but they do prevent currents of air when the doors are opened, and are a constant reminder of the necessity of care. The preparation of one room for a sick-room in a house, especially where there are children, is a wise measure. Such a room is not infrequently found in modern houses, and should be more common. In building a new house, a hospital room should always be arranged for. It may be made as cheerful and as available for ordinary use as any other room. The walls and ceilings are painted or covered with washable paper. The floor is polished and covered with rugs instead of a carpet. The hangings are easily removable, and there is no upholstered furniture. The furniture is of polished wood or white enamel, and is made without carving or deep

grooves. A room thus arranged can be quickly put into commission as a sick-room and will greatly simplify the question of prevention.

That isolation may be complete, it is necessary that the attendant be isolated with the patient. The importance of a competent and experienced nurse is very great. Important measures of prevention are frequently overlooked by those who have not had previous experience. Certain measures are sometimes rigidly enforced, while others of equal importance are neglected. The disease may thus be spread by leaving a single loophole unguarded. An experienced nurse will avoid many errors which the most conscientious person without such experience may make.

The ease of preventing the spread of a contagious disease is greatly augmented if there can be a third person to act as an intermediary between the nurse and the person who has the care of the other children. To this person may be assigned the duty of carrying the food and various articles required by the nurse, carrying away the soiled clothing, and performing the numerous offices outside the sick-room. She thus comes into close contact with neither the sick nor the well. In the houses of the well-to-do, where nurses are

employed, a trusted servant may perform this office. It is a hardship for the mother to make a choice between the invalid and the other children, particularly if they are small, but the necessity of doing so is undoubted.

Every person who enters a room in which there is a patient ill with one of the more serious contagious diseases, particularly diphtheria and scarlet fever, should wear a gown or some loosely fitting outer garment, which can be easily removed upon leaving the room. Such a gown can be made very cheaply of cotton cloth. It should be made to button closely about the neck and wrists, and should be long enough to reach the feet. It should be put on before entering the sick-room, and should be hung up in the bathroom or other suitable place upon leaving. A cap to protect the hair is desirable, but not as necessary as the gown. By observing this precaution, a father may visit the child without the danger of conveying the disease to others. Attending physicians should wear a gown during every visit to diphtheria and scarlet fever cases, and should thoroughly disinfect the hands and face upon leaving the patient.

The use of antiseptics has been rendered much more exact as our knowledge of the action of germs has become more exact. We know that

the infective principle is not a miasma, vapour, or intangible gas, but a germ which must be killed to be rendered harmless. It is impossible to fill the air of a room with any vapour of sufficient strength to kill these germs, which are very tenacious of life, without also killing or injuring the human occupants. It is utterly useless to attempt to prevent contagion by placing dishes of antiseptics in a room. Such methods should be avoided, as they tend to engender a false feeling of security, which leads to the neglect of more important measures.

The chief means of obtaining an aseptic condition is cleanness—complete, scrupulous, persistent. This involves the care of the patient, his bedding, clothing, room, and all that is about him. It is of particular importance in diseases like scarlet fever, diphtheria, and typhoid, in which the infective germs are contained in the secretion of the throat and nose or are thrown off by the skin and bowels.

As it is not always possible to prevent bacteria escaping from a person ill with a contagious disease, nor to prevent their being disseminated about rooms and buildings, the use of antiseptics is sometimes required. One of the best chemical antiseptics is a solution of the bichloride

of mercury. This may be made by dissolving a bichloride tablet, commonly known as an antiseptic tablet, in a pint of water, which makes a solution of 1 to 1,000, which means one part of the chemical in 1,000 parts of water. If a solution of 1 to 4,000 is required, the tablet should be dissolved in four pints of water. Bichloride solutions are odourless and do not stain. They change the colour of some fabrics, and corrode metals. They should always be made in porcelain vessels, and should not be used for instruments or other metallic substances. The standard solution of 1 to 1,000 may also be made by dissolving one drachm of bichloride of mercury and one ounce of common salt in one gallon of water. This solution, made either by the above formula or by the use of an antiseptic tablet in a pint of water, will be known through this book as the *bichloride solution*. As this solution is corrosive and very poisonous, but at the same time colourless and odourless, it is especially dangerous for household use. Although many accidents result from the use of carbolic acid, it is, after all, safer than bichloride, and should usually be selected when an active antiseptic is required.

When small amounts of carbolic solution are needed for household purposes, one teaspoonful

may be used in a pint of water. The solution should always be made in a pitcher or basin and thoroughly stirred. When a larger amount of solution is required, it may be made by dissolving six ounces of carbolic acid in a gallon of water. This will be known hereafter as the *carbolic solution*. Such a solution does not corrode metals nor destroy cloth or other fabrics. It is objectionable because of its odour and poisonous qualities. The refined carbolic acid should be used, as the crude drug has a deep colour and bad odour and is less effective.

For various conditions requiring disinfection these solutions may be used as follows:

For the hands and person, the carbolic solution in one-half or one-third strength.

For clothing, towels, and bedding, the carbolic solution in full strength for one hour, after which they should be boiled.

For closets, drains and sinks, either solution in full strength.

All discharges from the mouth, nose, bladder, and bowels should be received in glass or porcelain vessels. Either solution should then be added in full strength and at least twice the volume of the discharge. After standing for one hour, the whole may be thrown into the closet.

For sputa cups, full strength carbolic solution should be used.

Certain dishes should be reserved for the sole use of the patient. They should be disinfected with full-strength carbolic solution and then boiled and rinsed. The remains of meals should be burned.

When the patient has recovered, the entire body should be bathed and the hair washed with hot water and soap. He should then be dressed in clean clothes (which have not been in the room during his sickness) and removed from the room.

The bodies of those who have died from contagious diseases should be wrapped in clothes saturated with either solution, preferably the bichloride, in full strength.

All these antiseptics in strong solution are more or less irritating to the skin. For use about the eyes and various other places a saturated solution (as much as will dissolve) of boric acid is largely used. Boracic acid and boric acid are two names for the same substance. It is a mild antiseptic, and is not poisonous nor irritating to the skin and mucous membranes.

It should not be forgotten that prolonged boiling is one of the best antiseptic measures at our command. Hence, towels, handkerchiefs, and all kinds

of articles of clothing and bedding which can be boiled or steamed, may be thus sterilized. Handkerchiefs and towels should be used about contagious patients as little as possible. In their place, pieces of old cloth or squares of cheese-cloth should be used. They can be burned, thus avoiding the trouble and possible danger from imperfect disinfection. If they cannot be at once burned, they should be dropped into one of the full-strength solutions. If the floor of the sick-room be bare, it should be washed daily with the solution of bichloride in half strength. If carpeted, the carpet should be brushed over daily with the same solution.

At the termination of such diseases as diphtheria, scarlet fever, and smallpox, all toys and books should be destroyed. Books are particularly dangerous, for they cannot be adequately disinfected. The room should be washed—floors, walls, ceiling—with a full-strength bichloride solution, and the furniture should be wiped with the same antiseptic. Carpets, upholstery, hangings, bedding, and mattresses should, if possible, be disinfected with steam. When this is impossible, they should be wiped thoroughly with cloths dampened in the bichloride solution and then fumigated. After this they should be hung for days in the open

air and sunlight. As it is difficult to certainly disinfect articles of this character except by steam, all those of lesser value should be sacrificed.

Before the sick-room is occupied it should be thoroughly fumigated. Fumigation with sulphur, as it is ordinarily done, is ineffective, owing to the small amount of sulphur used and the dryness of the atmosphere. The various objects in the room should be dampened, and steam should be generated in it if possible. Three pounds of sulphur are necessary for each 1,000 cubic feet of air space. The sulphur is best used in the form of fumigating candles, which may be found in every drug store. It is best to place each candle in a shallow basin of water to avoid danger of fire. The room should be sealed by placing strips of paper over all cracks and keyholes. It should be kept closed for at least six hours after the sulphur is lighted, and should be thoroughly aired before it is again occupied.

Formaldehyde gas is superior to sulphur for room disinfection. It is commonly generated from formalin, which is a solution of formaldehyde in water. For this purpose several generators have been devised. Not less than six ounces of formalin should be used for each 1,000 cubic feet of space, and infected articles should be exposed to its action for not less than four hours. Formaldehyde

burns easily, and may be set on fire by an open flame. It is an excellent deodorizer as well as disinfectant. The necessary apparatus is now in the hands of most boards of health, and a small generator sufficient for the disinfection of rooms of ordinary size can be obtained at not large expense. In the absence of a generator, the formalin may be evaporated from the sheets suspended in the room. It is very irritating, and must be handled with care.

CHAPTER V

The Infectious Diseases

TUBERCULOSIS

Tuberculosis is characterized by the formation of small nodules (tubercles) in various tissues of the body. These tubercles increase in size and undergo one of two changes. They either soften and undergo a peculiar kind of degeneration, which renders them destructive and dangerous, or they harden and shrink and become harmless. There is not a tissue of the body which may not become tuberculous. Tuberculosis is one of the most protean of diseases. In the lungs it becomes phthisis or consumption; in the brain it causes one form of meningitis. In the spinal column it produces Pott's disease, with the resulting deformities of the hunchback. In the joints it appears as hip disease or other joint disease; upon the skin as lupus; in the glands as scrofula. It may invade the liver, bowels, kidney, throat, and bones—no tissue is exempt from its attacks.

Tuberculosis is world-wide in its distribution. It is found in every country and in every zone

from the arctic to the torrid. It is at present the greatest scourge among diseases, and is properly placed first among destroyers of human life. One-seventh of all deaths are caused by it. In the United States about 150,000 die annually from tuberculosis in its various forms. In the larger cities it causes more deaths than do scarlet fever, diphtheria, typhoid fever, and diarrheal diseases combined. It is, however, diminishing rapidly, and the death rate is believed to be at least one-third lower than it was twenty years ago. In Massachusetts the rate fell from 42 in 1853 to 21.8 in 1895. The reduction in the mortality from tuberculosis in New York City since 1886 has been over forty per cent., which means a decrease of more than 6,000 deaths annually in the greater city. But even yet it causes almost one-third of all deaths between fifteen and forty-five.

It occurs not only in man, but also in some of the animals upon which he is dependent, especially the bovine species. It is a significant fact that animals that do not have tuberculosis in their native state sometimes become subject to it in captivity. It is particularly prevalent in those portions of large cities where people are crowded together to such an extent as to materially lower their vitality. In New York City its occurrence

a few years ago, per 100,000 population, among different nationalities, was as follows: Irish, 645; Colored, 531; German, 328; American, 205; Polish Jews, 76. The peculiar immunity shown by the Jews has been observed in all lands.

The immediate or exciting cause of tuberculosis is the *bacillus tuberculosis.* It is a parasitic germ in the strictest sense, as it grows only in the animal body. In a dried state it remains dormant, and may retain its vitality for weeks or months. It is extremely susceptible to direct sunlight, and may be killed by a short exposure. It is killed in a few minutes by the temperature of boiling water, but cannot be killed by freezing. It does not thrive in dry, clear air, but remains alive for long periods in damp, dark rooms. It has the peculiar property of stimulating the cells of the body, wherever it lodges and grows, to the formation of the little nodules known as tubercles. It is in this way that it produces tuberculosis.

Although tuberculosis never develops except as the result of infection by the bacilli, the predisposing causes are important and have a potent effect upon the occurrence of the disease. Hereditary tendency is an active predisposing cause, but it should be clearly understood that there is no direct hereditary transmission of tubercu-

losis, except in rare cases, during the first few months of life. There is sometimes, however, an inherited susceptibility to tubercular bacilli. This susceptibility is especially marked at certain ages, differing somewhat in different families. Having passed this age with safety, the tendency frequently seems to disappear, and the patient may go on in safety through a long life. Susceptibility is always greater when resistance is diminished, as from overwork, or after grip or other disease.

The most common portals of entrance for tubercle bacilli are the lungs, the alimentary tract, and wounds of the skin. Of these, the lungs are by far the most commonly involved. While the bacilli may be taken into the body with the food, such mode of infection is infrequent. Whether they are transmitted to man from cattle, either through milk or meat, is at present a debated question, but the greater number of observers are strongly of the opinion that this may occur. Certain it is that in the vast majority of cases the bacilli enter the body through the respiratory passages, mingled with dust.

The most important source of tuberculosis is the tuberculous patient. This is particularly so when the disease involves the lungs. The sputum of such patients contains the bacilli in large num-

bers. If deposited in places where it may dry and become pulverized the germs may readily gain entrance to the lungs of others. The most common mode of infection is the inhalation of air contaminated by dried and pulverized sputa of consumptives.

The question of the contagiousness of tuberculosis has been recently raised by action of the United States emigration authorities in classifying it as a contagious disease. This action is regarded by most competent authorities as unfortunate. The disease cannot be contracted by simply coming into contact with a tuberculous subject. The impression that it is contagious can accomplish no good in the direction of prevention, and would work grievous hardships upon many tuberculous patients. With the fact established that tuberculosis is not directly contagious, but is commonly transmitted by sputa, prevention is comparatively easy. A consumptive need be in no respect a source of danger to his friends. Numerous details of management must be enforced, but by far the most important precaution is that consumptives should expectorate only into receptacles containing antiseptic fluids, or upon something that can be destroyed by fire. Prevention consists in the proper disposal of the sputa of consumptives, in

surrounding those unfortunates with abundance of fresh air and sunlight, and in the destruction of every tuberculous animal.

The first step in prevention, therefore, should be to inform the sufferer from tuberculosis of the nature of his disease. Objection is often raised to this course on the ground that it will add discouragement to the other burdens of the illness. If the information is given in the proper way this need not be the result. After the first surprise, tuberculous patients are rarely, if ever, made worse by the knowledge, but go through the slow progress of the disease more easily, if they know something of its true nature. It is hope deferred that maketh the heart sick, and the physician sees no more pitiful sight than the tuberculous patient constantly looking for the improvement which does not come. He often goes from place to place, and from doctor to doctor, and fails to gain the relief and comfort which a consistent plan of treatment laid down by a physician in possession of all the facts in the case might give. But even to save the feelings of the one, is it right to deliberately risk the lives of the many? Tuberculous subjects should certainly be informed sufficiently of the nature of their disease to make them careful in the carrying out of the

precautions necessary to prevent its transmission to others.

A knowledge of tuberculosis and its methods of transmission readily suggests methods of prevention. The first and most important measure should be the care of the sputa, which should be received in proper receptacles or upon cloth which can be burned. In the house, such receptacles should be of glass or china. They should contain a carbolic or bichloride solution, and should be scalded with boiling water twice a day. The greatest care should be exercised by the patient that none of the sputa escape beyond the fluid. Sputa cups made of thick paper may be obtained in most drug stores. They are cheap, and should be burned after being used. When it is not convenient to use such a receptacle, the patient should expectorate into old cloths or squares of cheesecloth. These also should be burned. A cheap and excellent substitute are the Japanese napkins of paper. Several sputa flasks designed to be carried in the pocket have been devised. One of the best of these is known as the Knopf flask, and can be obtained at instrument stores. The best flask, however, is probably that known as the Marine Hospital sputa flask, made by the Kny-Scheerer Company, of New York. It does

not spill, can be readily sterilized, and, above all, from a practical point of view, can be used in a handkerchief without attracting attention.

Both the patient and his friends should be impressed with two points: first, that he is a possible source of danger, and may transmit the disease to others; and second, that he is not necessarily a source of danger to any one. By observing strictly certain not irksome precautions, he may live in the family with entire safety to others. "The consumptive himself," says Cornet, "is almost harmless, and only becomes so through bad habits."

All clothing and bedding soiled by the sputa or other discharges of tuberculous patients should be at once boiled, and the dishes he uses should be thoroughly scalded after each meal. Scrupulous personal cleanliness should be strictly enforced, and kissing should be forbidden. The patient should wash his hands frequently, for it is possible that he may convey the bacilli to the dishes, food, or other articles which will be used by others. Where these precautions are carried out there is no necessity for disinfection of rooms and apartments. Where they have not been scrupulously carried out, the rooms in which the tuberculous patient

has lived should be thoroughly fumigated and washed with antiseptic solutions.

The sanatorium treatment of tuberculosis has of late received much attention, both popular and professional. There are in every community, particularly in cities, a large number of tubercular subjects who are unable to care properly for themselves. Such individuals may very justly become public charges, as much for the welfare of the community as from charitable motives. Such care of the poor and ignorant will remove a fruitful source of public danger. There is still another class of intelligent people, who would gladly carry out every detail of prevention and would be benefited by removal from home to a hygienic region. Great numbers of this class are prevented from doing so by financial reasons. There is urgent need of sanatoria where such unfortunates can go at small expense. Under present conditions the great majority of tuberculous subjects must not only want for proper care and hygienic surroundings, but they must be to a greater or less degree a menace to others and foci for the dissemination of disease.

The belief of former years that consumption is necessarily a fatal disease is now well known to be untrue. Many recover even in large cities. When

the proper climatic, hygienic and medical treatment is begun early, the possibilities of recovery are excellent.

About sixty per cent. of all the people who die in the New York hospitals show, if autopsy is made, that at some time in their lives they have had tuberculosis. Only half of this number die of it, however. The remainder recover, and in most instances have never known of its existence in their systems.

It should be fully understood that there is no specific treatment, and that there is no drug, antitoxin or vapour known which can in any sense be considered a cure. The Committee on the Prevention of Tuberculosis of the Charity Organization Society of New York has recently spoken very positively on the subject in the following resolution: "There is no specific medicine for this disease known, and the so-called cures and specifics and special methods of treatment widely advertised in the daily papers are, in the opinion of the Committee, without special value, and do not at all justify the extravagant claims made for them, and serve chiefly to enrich the promoters at the expense of the poor and frequently ignorant and credulous consumptives. It is the unanimous opinion of the Committee that no cure can be

expected from any kind of medicine or method except the regularly accepted treatment which relies mainly upon pure air and nourishing food." These advertised methods of sure cures for consumption do great harm in raising hopes which end only in disappointment and in delaying the beginning of rational treatment.

The tuberculin devised some years ago by Koch failed to fulfil the hopes that were based upon it. As yet no antitoxin has been produced, although great labour has been expended in that direction. There certainly seems at the present writing to be some hope that such an element may be obtained in the not distant future which will prove of value in the early stages. Owing to peculiarities in the growth of the tubercle germ, the obstacles in the way of securing an antitoxin are very great. The Röntgen treatment promises something, but its use at the best will probably be limited to certain special classes of cases. The germs are deeply embedded in the tissues, beyond the reach of any known germicide or antiseptic.

The most rational and successful treatment at present available consists in placing the tissues in a favourable condition to combat the bacilli. This is accomplished by the use of certain diet and drugs, and by removing the patient to the pure air

and sunlight of the mountains. The outdoor life now enforced in all sanatoria is particularly important. Along these lines of treatment substantial advancement has been made, and many lives are to-day saved which twenty years ago would have been lost.

TYPHOID FEVER

Typhoid fever is a communicable, infectious disease, but is not contagious. It is caused by the *bacillus typhosus*, discovered by Eberth in 1884. It occurs in all countries, but is more common in those of the temperate zone. Although sporadic cases frequently develop, they do not occur spontaneously, but are the result of germs derived from some previous case. It is so much more common in the fall that it was formerly known as autumnal fever. In England it is commonly called enteric fever. Although most frequent in August and early autumn, epidemics as well as sporadic cases may occur at any time. Typhoid fever normally runs a course of four weeks, several weeks longer being required for convalescence. Its chief local manifestation is ulceration of the bowels. In fatal cases death results from perforation of one of these ulcers, from hemorrhage, from the direct poison of the disease, or from exhaustion.

Typhoid fever is one of the most important

diseases of civil life, while no other disease causes such havoc among encamped armies. Armies upon the move are little affected by it. During the Spanish-American war there were 20,738 cases, affecting almost one-fifth of the encamped strength of the American army. It caused more than eighty-six per cent. of all the deaths on the American side during the war. In the German army before Metz, 31.8 of the troops suffered from the disease. In civil life it is largely a disease of young adults, being most frequent between fifteen and twenty-five years.

The bacillus of typhoid is a non-spore-forming germ, developing outside the body as well as within it. It is killed by a temperature considerably below that of boiling water, but resists freezing. It has been found active in ice after eighteen weeks, though a majority of the bacilli die within two weeks. It is killed in a few hours by direct sunlight, but resists drying for months. It has been found alive in street dust after thirty days. It will live in ordinary water for fourteen days, but increases in water very slightly. In milk, however, it develops vigorously, and has been found alive in sour milk after three months, and for several days in butter. The disease is not directly contagious, but in the great majority of cases enters the system

through the digestive tract. The dictum of Ernest Hart is entirely true: "You can eat typhoid and you can drink typhoid, but you cannot catch typhoid."

Among the common modes of infection are directly carrying the bacilli into the mouth by the hands, and the contamination of the food by soiled hands, dust, and flies. They may also be conveyed by clothing and dishes. They are very tenacious, and simple washing of the hands with soap and water is not always sufficient to remove them. A disinfectant is required for that purpose. Those who are nursing typhoid patients cannot be too cautious in this particular, for they may readily infect not only themselves, but others. The germs are eliminated by the patient in the discharges from the bowels and kidneys, and occasionally, perhaps, in the saliva.

The measures necessary for preventing the transmission of the bacilli are numerous and must be carried out with precision. In scarcely any other disease, therefore, are the services of a trained nurse more desirable. Many details of management are learned by experience which can be taught in no other way. The most important of these details in the direction of prevention is scrupulous cleanliness of the patient, his bedding

and clothing. As the care of the sputa is important in tuberculosis and diphtheria, so the care of the dejecta is important in typhoid.

In civil life the disease is transmitted by water more commonly than by any other means. Epidemics are frequently due to a contaminated water supply. A single case of the fever in which the discharges are allowed to drain into a stream may infect hundreds of people using the water below the point of contamination. Numerous epidemics have also resulted from infected milk. The bacilli are commonly introduced into the milk in water used for washing the cans or dishonestly added by the dairyman or dealer. It has been caused, also, by the use of green vegetables and salads which have been fertilized with mixtures infected with typhoid bacilli. Oysters that have been "fattened" in waters infected with typhoid evacuations have also caused the disease. It has been abundantly proved that flies have carried infection and deposited it upon food. This is one of the most common means of its dissemination in camps. Cases of "walking typhoid" are fruitful sources for the dissemination of the disease. They are just as dangerous as the more serious cases, and scatter bacilli broadcast.

Typhoid fever is not a filth disease in the sense that it may originate from filth alone. In fact, it is not confined to the poor and those living in filthy surroundings, but has a rather strong predilection for the wealthy. Filth, sewers, and cesspools cannot themselves cause the disease, but they furnish conditions favourable for the preservation of the bacilli, and the disease may thus originate from them after the patient that infected them has been forgotten. A well once infected may be dangerous for months or years. Hence old wells in cities and villages are often plague spots. Even the wells on farms may be such, for cesspools and the vaults of outhouses are often placed in such close proximity that the wells become drainage points for filth, if not actual disease. The safest water supply for villages and farms is an artesian or driven well, or a deep issuing spring that is protected from contamination. The amount of typhoid caused every year among summer boarders by an infected water supply is appalling and unnecessary.

Prevention of typhoid consists in the isolation and strict cleanliness of the patient, his clothing and bedding, and the carrying out of all the details advised for the care of the diphtheria patient. Disinfection of all discharges and soiled articles

with strong carbolic or bichloride solutions should be practised. In the country the discharges should then be buried deeply, at a safe distance from any well. The boiling of all water not known to be beyond suspicion, and the pasteurizing of milk, is necessary. Notwithstanding every precaution, the disease will sometimes occur, and in many cases no clue to the origin can ever be found.

One of the discoveries of comparatively recent years which has proved of great value in the diagnosis of typhoid is the peculiar appearance known as "Widal's reaction." If a few drops of the blood of a patient who is suffering from typhoid or has recently had the disease be applied to typhoid bacilli, cultures of which are kept in laboratories for that purpose, they may be seen under the microscope to undergo a peculiar and characteristic change. As the diagnosis of the disease is frequently very difficult during the first week, this often proves of great assistance, for the reaction can sometimes be obtained as early as the fourth or fifth day. It assists also in determining the nature of mild cases, for the disease sometimes runs a mild and not characteristic course. As these mild cases are infectious, their diagnosis is always important.

DIPHTHERIA

Diphtheria is an infectious and contagious disease characterized by the formation of a false membrane upon some mucous membrane or abraded surface. It commonly appears on the tonsils and throat, but not infrequently involves the nasal passages and larynx. It is accompanied by symptoms of infection, with prostration and heart weakness. It is extremely variable in its severity; it may be very mild or intensely malignant.

Its history is strange and interesting, for it has had periods of quiescence followed by periods of virulent and widespread epidemics. It was described by early Greek physicians, and epidemics have appeared through all the centuries of medieval and modern history. It was prevalent in the American colonies, and in 1771 Doctor Bard of New York wrote an admirable description of it. It then rapidly subsided, and if it appeared at all in this country for almost a century, did so only in occasional sporadic cases. Suddenly, in 1857, it appeared in the coast towns of New England in malignant form. It spread rapidly throughout the country, and soon became one of the most formidable diseases of modern times. It has entrenched itself in almost every large town of

Europe and America, and few even of the most remote localities have escaped its visits. In fact, the epidemics which sometimes occur in country districts are particularly severe.

Diphtheria is due to the *bacillus diphtheriæ*, which was discovered by Klebs in 1883 and was further described by Löffler. It is, therefore, commonly known as the Klebs-Löffler bacillus. It is a facultative germ, and develops freely outside the body. Damp, dark places, with decomposing animal or vegetable matter, are admirably adapted for its propagation. A cesspool or sewer into which a few diphtheritic bacilli have been introduced may be a focus of a widespread epidemic months afterward. Drying does not destroy their vitality, and they are frequently conveyed in dust. They are killed by heat below the boiling point, and do not form spores. Owing to the fact that they develop so freely outside of the body, and are so resistent to drying, it is very difficult to eradicate them from a locality into which they have been introduced.

The development of the diphtheria bacilli in the body is unique among bacteria. They are not found in the blood or tissues, but only in the pseudo-membrane, particularly in the deeper layers. Here they grow and generate their poison,

which is absorbed into the system of the patient. The diphtheritic membrane is, so to speak, a laboratory in which the germs work and elaborate a chemical product of extraordinary virulence. As a rule, therefore, the more extensive the membrane the more serious the disease. When it invades the back of the throat and nasal passages it is particularly dangerous, for absorption into the system from these localities is very active.

It is frequently impossible to discover the source of the infection, for the germs may be carried long distances by clothing, or may be inhaled from the air where they are least expected. The channels of infection are so numerous, particularly in large cities, that no positive rules for avoiding the disease can be given. One of the most dangerous sources is the occasional "walking" case, with whom any child may come in contact. Strict isolation should be enforced, not only of every diphtheritic patient, but of every child suffering with sore throat, until its character is positively determined. The onset is often insidious, the membrane being well developed and the patient a source of infection before serious general symptoms appear. Schools are often sources of infection, and should be under medical inspection.

Opinions regarding dissemination of diphtheria

have materially changed in the last ten years. There is no evidence to show that the bacilli are disseminated by water, and the popular belief that diphtheria is spread by the air from open drains and sewers is, without doubt, erroneous. Numerous carefully conducted investigations have failed to detect them in such air. Particles of membrane coughed out, dried, and pulverized may cause the dissemination of dried but active germs, but it does not seem possible that they can escape into the air from damp surfaces, and they have not been so found.

All secretions of the mouth, throat, nose, ears, or other localities invaded by diphtheria are loaded with bacilli. These bacilli, when dried, may be conveyed to any distance and through long periods of time by clothing, bedding, towels, handkerchiefs, dishes, and every article used about the patient. The same rules regarding their care and disinfection should be enforced as has been suggested for tuberculosis, but with even greater thoroughness, for the germs are more virulent than are those of tuberculosis.

A measure of great utility in diagnosis is the making of cultures from the throat of suspected cases. A bit of secretion is obtained from the throat by means of a small swab and smeared on

the surface of gelatin placed in a test tube. This test tube is then sent to the laboratory, where a bacteriologist in a few hours determines whether the bacilli be present or not. The importance of this knowledge cannot be overestimated. In the early stages the diagnosis is often difficult, and certainty as to the character of the disease is thus quickly attained. It is one of the most important steps toward exactness taken by modern medicine.

Of equally great importance is the knowledge afforded by such cultures as to when the bacilli have disappeared from the throat. As long as they remain the child is capable of transmitting the disease to others. It has been found that they are frequently present in a semi-dormant state for two weeks after the membrane has disappeared and the patient is apparently well. In rare cases they have been found to persist for three, four, and even six weeks. While it is true that these belated germs are not always virulent, it would be an unjustifiable risk to allow a child in whom they are present to mingle with others. These facts demonstrate the difficulty of controlling diphtheria and tracing the source of infection. No one can ever be certain upon entering a crowded place that some one may not have in his throat active diphtheria germs, or, in fact, the germs of other diseases.

The attempt upon the part of boards of health to stop the dangerous habit of spitting in public places ought to receive the hearty support of every decent citizen. Disease is often transmitted by food which has been contaminated from human sources. Little shops with families living in close proximity have frequently been in this way the unsuspected source of diphtheria and scarlet fever. Milk in open cans is particularly prone to absorb bacteria.

Study of the modes of dissemination of diphtheria suggests many measures of prevention. Every detail of isolation and disinfection should be observed. All soiled clothing, as far as possible, should be burned. While all these measures should be strictly enforced, by all means the most important and valuable method of prevention is the injection of small doses of antitoxin. The importance of this cannot be too strongly insisted upon. The subject will be considered in more detail in the chapter on antitoxin.

The knowledge that the diphtheria bacilli are found only in the pseudo-membrane, which is usually in sight and accessible in the throat, leads at first to the thought that treatment and prevention must be very simple. As a matter of fact, however, the bacilli are deeply embedded, and soaking the membrane for an hour in a much

stronger antiseptic solution than can be safely used in the throat fails to destroy them. The antiseptic treatment, however, while an improvement over older methods, is disappointing. Forcible removal causes great suffering, and sometimes fatal shock, and hemorrhage, and is invariably followed by a recurrence of the membrane with more severe symptoms. All such methods have been superseded by antitoxin.

Mixed Infections.—A considerable portion of cases of diphtheria are "mixed infections," by which we mean that other bacteria are present, as well as the diphtheritic bacilli. These bacteria are usually streptococci. They cause many of the septic symptoms so commonly seen in diphtheria, and explain in a measure the variability of the disease. When present they add greatly to the gravity of the case.

Pseudo-Diphtheria.—The Klebs-Löffler bacillus is not the only germ capable of causing a pseudomembrane to form in the throat. Certain streptococci also have this power. The membranes they form simulate very closely that of true diphtheria, and can frequently be distinguished only by bacterial culture. It is important, however, that this distinction should be made. The one is a comparatively mild disease, with a low death rate.

The other is grave, and is frequently malignant, with a death rate appallingly high. These facts account largely for the varying rate of mortality reported in different epidemics and in the practice of different physicians. Many cases of false diphtheria have no doubt been considered as true diphtheria. Statistics based upon cases in which a bacterial examination has not been made are not now regarded as reliable. The diphtheria caused by germs other than the Klebs-Löffler bacillus is known as pseudo-diphtheria. It is an interesting fact that the membranous sore throat which appears in the first stage of scarlet fever, and sometimes of other diseases, is usually pseudo-diphtheria, while throats of similar appearance occurring in the late stages are usually true diphtheria. As a complication of other diseases, pseudo-diphtheria may be very serious.

Membranous Croup.—True or membranous croup should be distinguished from false or spasmodic croup. The latter is that disease which comes on suddenly about eleven o'clock at night with a loud barking cough, and often with marked symptoms. It subsides after a few hours, and on the following day the child may show but few symptoms beyond those of a bronchial cold. The attack is frequently repeated on the following night. True croup comes

on insidiously, and the symptoms are very rarely urgent until many hours have passed. False croup is due to catarrhal cold and spasm of the larynx. True croup is due in about 85 cases in 100 to diphtheria. In the remaining cases it is due to pseudo-diphtheria. In either case it is caused by the formation of a membrane in the narrow portion of the throat about the vocal cords. Untreated, it is one of the most fatal diseases of childhood, the mortality being more than 90 per cent. It causes death by direct mechanical obstruction. The membrane may extend from the tonsils and pharynx, or it may originate in the larynx. In the latter case the difficulties in early diagnosis between true and false croup are often great. The patient with croup should be isolated, and every precaution should be taken as for diphtheria, for it usually is diphtheritic, and no skill except that of the bacteriologist can determine that it is not. In any case of sore throat, it is a wise precaution to isolate the patient until the nature of the disease has been determined. Throats apparently innocent at the outset sometimes show themselves later to be diphtheritic in nature. Every case of croup should be treated with antitoxin promptly. If urgent symptoms develop, intubation should be performed as advised in the section on antitoxin.

SCARLET FEVER

Scarlatina, or scarlet fever, is an acute, infectious, contagious disease, typical cases of which present the following features: After a period of incubation of from two to four days there is a sudden onset of sore throat, vomiting, and fever; within twenty-four hours an eruption appears on the neck and rapidly spreads over the body; it continues for about six days, when it terminates in desquamation, which continues for three weeks or longer. The possible complications are numerous and grave, and render the disease one of the most serious of childhood.

Scarlet fever is rare before one year and is most frequent between five and eight years. After the latter age the susceptibility diminishes, and is very slight during adult life. That scarlet fever is an infectious disease does not admit of doubt, but the specific germ has not yet been discovered. It has, however, been fully demonstrated that streptococci play an important rôle in the causation of many of the symptoms. They are the cause of the membranous exudations in the throat, the inflammation of the ears and the glands, and probably also cause the kidney involvement, pneumonia, and joint inflammations which sometimes occur as complications. These germs are so

constant in their presence, and so active in the causation of the more serious symptoms and complications, that they are important factors of the disease. Scarlet fever is, in fact, commonly a mixed infection, the more malignant and fatal symptoms being due not so much to the primary as to the secondary infection. The specific germ exists in the blood, for inoculation of the serum into susceptible animals produces a typical attack of the disease. It is also found in the various secretions, and in the scales from the skin, as shown by their power to generate the disease. Susceptibility of the human organism to scarlet fever is less decided than it is to measles, exposure being far less frequently followed by illness.

Scarlet fever may be contracted by direct exposure or through intermediate infection. The chief source of direct infection is the patient himself, but the area of infection is limited to a few feet. Hence, close contact is necessary. The scales thrown off from the skin during desquamation are extremely infectious. The retention of these scales by clothing, bedding, and the walls of the room is one of the most common sources of infection. The purulent discharges which frequently occur during the disease are also infectious. Scarlet fever is spread by indirect infection more

frequently than is any other contagious disease except, possibly, diphtheria and smallpox. Its micro-organism is more tenacious of life than is that of any other disease except smallpox. Hence, it may be conveyed to long distances by clothing, carpets, bedding, books, toys, and letters. It may be conveyed in the fur of cats and dogs. The transmission of scarlet fever by milk and other articles of food is undoubted. There are numerous authentic cases in which it has been conveyed by letters written by hands in the stage of desquamation. Epidemics of scarlet fever usually spread slowly as compared to those of measles.

The incubation period is very short. While in a few apparently authentic cases it has been as long as ten days, it is rarely more than six days, and usually between two and four. It is occasionally less than one day. While the period of incubation is short, the contagious period is very long. In most cases it is not contagious until the rash has made its appearance. We have thus in scarlet fever a distinct advantage over measles, for in the latter disease the period of contagion begins two or three days before the rash appears. Children are frequently seen who have been in contact with scarlet fever patients several hours after the initial vomiting and have not contracted the disease. The

infective power is active when the eruption is at its height; it then diminishes, but increases again during the stage of desquamation.

The patient is dangerous to others as long as the slightest desquamation continues on any portion of the skin. The duration of this period is extremely variable, and a common error consists in being guided by a fixed number of days. The conventional forty days is only to be regarded as approximate. It is rarely too long. Desquamation is liable to persist in small areas of the body after it has disappeared from other portions. It is frequently very difficult to determine in such cases whether we have to deal with a local patch of scarlatinal desquamation, or with eczema brought about by irritation the result of over-zealousness in bathing and anointing. These circumscribed areas are most commonly found about the joints. Desquamation is liable to persist about the fingernails after it has disappeared from every other part of the body. There can be no more dangerous place for such persistence, for the scales are liable to fall upon any article handled, and they may thus be conveyed to a distance. The period of isolation is long, and desquamation is not the only factor by which it is to be determined. Purulent discharges contain the infective principle of

scarlet fever, and no child who is suffering from such a discharge should be allowed to mingle with others.

In few other diseases are preventive measures so productive of good results as in scarlet fever. Although a far more serious disease than measles, its spread may be more effectively controlled. No one will allege that the measures necessary to the attainment of that end can be carried out without encountering difficulties. They are many and complex, but are effective in preventing the spread of the disease. When we consider the high mortality of scarlet fever, and the grave sequela which are common in those who survive, we are forced to feel that neglect of preventive measures is little short of criminal. Certain measures are sometimes rigidly enforced, while others of equal importance are neglected. The disease may thus be spread by leaving a single loophole unguarded.

As the period of incubation in scarlet fever is short and somewhat variable, every child who is known to have been exposed should be absolutely quarantined. Although a feeling of security is warranted after four days, no person who has been exposed should be considered safe in less than a week. The question of sending other children

away from home is often a serious one. The objection is frequently made that they may carry the disease to other places, or the parents are unwilling to have them ill away from home. The decision must rest largely on the time of the exposure. If it occurred before the appearance of the eruption, there is but little danger that the disease has been contracted. If exposure occurred during the stage of eruption, the probability of illness is great. If the patient is isolated soon after the appearance of the initial symptoms, other children in the family are very unlikely to have taken the disease from him.

Inunction of the body with oil is prescribed by many physicians throughout the entire course of the disease. During the stage of eruption it is employed chiefly as a means of treatment. After desquamation has begun, the object of inunction is quite different. The procedure then becomes a matter of prevention as well as treatment, and the most important object is to soften and remove the scales, thus preventing their dissemination. It is the belief of many that the scales may be disinfected by adding antiseptics to the oily substance used for inunction. This seems somewhat doubtful, but the addition of a mild antiseptic can do no

harm. Caution should be taken, however, that neither the antiseptic nor the oil employed have an unpleasant odour. The appetite in this stage is prone to be poor, and a persistent disagreeable odour may increase this distaste for food and render the child irritable.

Fumigation of the room in which the scarlet fever patient has lived is more important than it is after most other infectious diseases. Where it is possible, formaldehyde should be used, and carpets, bedding, hangings, and mattresses should be disinfected with steam. The room, as well as all furniture, should be wiped with bichloride solution (page 57). The room should then be kept open to the air for several days, and no person who has not had the disease should enter it for many days or weeks. Particular care should be observed in the destruction of books and toys, and all fuzzy and furry objects, for they cannot be thoroughly disinfected. Caution should be observed also against packing away in trunks or boxes possibly infected articles. Thus excluded from the air and moisture, the germs of scarlet fever may retain their vitality for many months.

MEASLES

Rubeola, or measles, is an acute, infectious, contagious disease, which presents, when it pursues

a typical course, the following characteristics: After an incubation of twelve days there is a gradual invasion with dry cough, suffusion of the eyes, and catarrhal symptoms, followed on the fourth day by a coarse, blotchy eruption, which appears first on the sides of the face and neck and slowly spreads over the body. This eruption continues for about five days, when it fades away and is followed by a bran-like desquamation, which is usually completed within a week. It is most common during the first ten years of childhood, but is occasionally seen in adults. It is endemic in most centres of population, but at frequent intervals becomes epidemic. It occurs at all seasons, but is most common during cold weather.

Analogy leads to the belief that measles is due to a specific micro-organism, but it has not yet been isolated. While it must be an extremely diffusible germ, its vitality is small. It is at least a fact that measles is the most contagious of all the infectious diseases except smallpox. It is uncommon under six months, but above that age every child who has not already had it may be expected to contract it upon exposure. Adults are rather more susceptible to it than to the other infectious diseases.

Measles is usually conveyed by direct contact,

but the area of contagion is large. It is more difficult to confine it to a single room than almost any other disease. It may be conveyed by clothing, but this mode of diffusion is far less common than in scarlet fever. Although intermediate contagion may occur, it is comparatively rare. It may be thus transmitted by a nurse or person closely in contact with a patient who goes directly to a child who is not immune.

The infectious power of the poison is quickly lost, which probably means that the specific germ dies soon when dried. Sick-rooms, therefore, soon become safe for occupancy. This may occur in two weeks if the room can be freely open to the air. While it seems probable that the contagium may be conveyed by the breath, it is certain that it resides in the sputa and discharges from the nose and eyes. If these are dried and converted into dust, they may undoubtedly transmit the disease. The desquamation scales from the body are far less potent to convey the poison than are those of scarlet fever.

Measles is most contagious at the height of the attack, but it begins to be so from the very first appearance of the catarrhal symptoms, numerous cases being recorded in which it was transmitted four days before the rash appeared. This accounts

largely for the widespread character of the epidemics. Unless exposure is known, measles is usually not suspected, for the symptoms are those of a catarrhal cold. It is impossible in some cases, even when suspicion has been aroused, to determine the true nature of the symptoms before the end of the fourth day. Whenever it is desirable that the disease should not be transmitted to others, children with acute catarrhal colds should be isolated until the nature of the attack can be determined. Except in complicated cases, in which the catarrhal symptoms are prolonged, the period of contagion is not more than twenty-four days.

While measles usually runs a simple and uncomplicated course, complications occasionally arise, and are usually due to the presence of staphylococci. Streptococci are, however, sometimes present, and cause more serious trouble than the first-mentioned bacteria. As their presence is common in hospital wards, they render measles a disease much dreaded in hospitals for young children. They give rise to pneumonia, which is always a grave complication. Pneumonia is, in fact, the cause of death in ninety per cent. of fatal cases. It is comparatively common in some epidemics, while in others it is not frequently seen.

Death in uncomplicated cases in well-to-do private practice is rare in children more than four years of age. The mortality in all ages is probably from four to six per cent., but between one and three years it is often twenty per cent. During the first three months of 1902 there were 349 deaths in New York City due directly and indirectly to measles. This is evidence that the disease is not as harmless as it is often credited with being. It should never be neglected.

The high mortality of measles before three years suggests the advisability of taking particular precautions against the exposure of infants. Delicate children of the so-called scrofulous type, and those with a hereditary tendency to tuberculosis, should be especially guarded against exposure. In adults tuberculosis is not an uncommon sequel of measles, which seems to have the power of lighting up some old latent tubercular focus which would have otherwise lain dormant, or of rendering the patient especially susceptible to tubercular invasion. While measles is a far less serious disease than scarlet fever, and the great majority of cases pursue a favourable course and give no sequela, it is a graver disease than it is popularly credited with being, and should receive more attention than it often does. There are a number of mild diseases

which simulate it, and are often mistaken for it, which has, perhaps, added to the popular belief that it is a simple and unimportant disease.

The prevention of measles demands the early and absolute isolation of the sick. This should be continued for twenty-four days, and as much longer as purulent discharges from the nose, ears or eyes may continue. The period of quarantine for children who have been exposed should not be less than sixteen days, and twenty is preferable. The sick-room is less likely to prove dangerous than the scarlet fever sick-room. Unless time be an element of importance, fumigation is not required. Thorough cleansing and ventilation for two weeks after the patient has left it is sufficient to insure safety. As the infection of measles is not so persistent as that of scarlet fever, such prolonged precautions are not necessary, but during the height of the disease the same measures should be adopted.

GERMAN MEASLES

Rubella, rötheln, or German measles, is an acute, contagious, infectious disease, which simulates measles in some of its appearances. It appears under two general types, sometimes known as the measles type and the scarlet fever type. In the first there is a coarse rough red rash very

similar to that of measles. In the second form the rash is much finer and simulates that of scarlet fever. It is the belief of some at the present time that this is actually another disease, and they have called it the "fourth disease." The rash, it is certain, in the two forms is quite dissimilar, but the symptoms are very similar. The disease is mild, and the death rate, if there be any, is very small. It is contagious, but less so than measles. The catarrhal symptoms are mild and sometimes absent, and there is frequently no cough. While no germ has been found, there is no question that there is a specific germ, for the disease is not a modified form of either scarlet fever or measles. It frequently occurs in children who have had those diseases. In other words, it does not protect the individual either from scarlet fever or measles.

The term " German measles," by which it is so commonly known, is an unfortunate one, for it leads to much misunderstanding. It is difficult for many to appreciate that a person who has had one kind of "measles" is just as subject to another kind. While there is no question that measles sometimes occurs more than once in the same individual, many second attacks are accounted for on the ground of error regarding the nature of one or the other of them. It must be said that

the differential diagnosis between German measles and mild measles is sometimes very difficult, and it is possible for experienced physicians to be in doubt until the attack has nearly or quite completed its course.

This disease is so mild that when the diagnosis is undoubted, methods of prevention are not, as a rule, very vigorously enforced. When prevention is desirable the same course should be pursued as in the management of measles. The incubation is quite variable, ranging from six to eighteen days, the more common period being from twelve to sixteen days. Desquamation is very slight, and occurs in fine scales. It rarely lasts more than three or four days, and can often not be detected, particularly if the skin has been anointed or bathed daily. As German measles rarely occurs sporadically, but usually in epidemics, it is the course of wisdom to regard every case as perhaps mild scarlet fever or measles until its true nature has been absolutely demonstrated.

SMALLPOX

Variola, or smallpox, is an acute, infectious, and very contagious disease characterized by an eruption which passes through the stages of papule, vesicle, pustule, and crust. During the pustular stage the whole surface of the body is covered with festering

sores, and the disease is one of the most loathsome known. It is one of the most virulent of the contagious diseases, and those who are exposed, if unprotected by vaccination, are almost invariably attacked. Although contagious from the very first symptom, it is particularly so during the convalescent period, when desquamation is active. The contagion is widely diffusible through the air, and may be conveyed by clothing or bedding. It persists in rooms with extreme tenacity. It may be conveyed by persons who have been in contact with the sick or with articles which have been contaminated with the purulent discharges. As the specific germs are contained in the fluid of the sores, and persistent in the dried scales, it is very difficult to limit their diffusion. The scales, dried and converted into dust, may disseminate the disease as scarlet fever is disseminated.

In view of these facts, it is one of the most unmanageable of diseases in localities where numbers of the unvaccinated may come in contact with it. In most cases it is transmitted through the air. Simply breathing the air of the room in which a smallpox patient is ill, or coming in contact with such a patient in the open air, is sufficient exposure to cause the disease.

Smallpox has appeared in nearly every nation of the globe, and is of ancient date. The "great plague" described by Galen was probably smallpox. Further facts regarding the disease will be found in the chapter on vaccination.

One method of prevention is so preëminent above all others that it must receive chief attention. That method is vaccination. It is not only sufficient for preventing the occurrence of the disease in the individual, but if universally carried out eradicates it so that it disappears. In view of the fact, however, that there is always in this country a considerable number of individuals who for one reason or another have not been vaccinated, the most stringent methods of isolation and disinfection should be enforced. The health authorities are entirely justified in forcibly removing smallpox patients to hospitals. Failure to promptly notify the health authorities of its appearance should be punished by heavy penalties. Where the disease does appear, the directions given for the management of scarlet fever should be enforced with the greatest thoroughness, and fumigation should be done with more than usual care. Every city should have properly equipped hospitals for the treatment of smallpox, so arranged that they can be extended to accommo-

date the unusual numbers which may require treatment during an epidemic. The complaints sometimes made because all classes of patients are treated together are scarcely warranted. Public authorities could not properly discriminate and offer better conditions to one than to another. The proposition recently made in New York to build a hospital for private patients by private subscriptions was foredoomed to failure. The initial expense of constructing such a hospital, and the continual expense of maintaining it, and keeping physicians and nurses ready at any moment to receive a patient during the long intervals between epidemics, would be very great. There are months together in New York City when no case is reported. People of wealth, who have taken the precaution of protecting themselves and their families against the disease by the simple process of vaccination, can hardly be expected to give large sums of money for the benefit of those who do not take such precautions.

CHICKEN-POX

Varicella, or chicken-pox, is an acute, contagious disease, characterized by mild general symptoms and an eruption of papulæ and vesicles. It is entirely distinct from smallpox, although one of its chief points of importance is the difficulty occa-

sionally experienced in distinguishing it from that disease in its early stage. Its diagnosis is usually, however, very easy. It affects children of all ages, but particularly those under four years. It is very contagious, and few children escape it. The incubation is from twelve to sixteen days. It is contagious from the onset, and continues so until the vesicles are dried. Although clearly an infectious disease, its germ has not been discovered. It is known to lie in the contents of the vesicles, for it can be transmitted by inoculation. The disease is so mild that preventive measures are rarely enforced. When such measures are desirable they are similar to those advised for measles. Chicken-pox rarely occurs more than once in the same individual.

MUMPS

Parotitis, or mumps, is an acute, contagious disease, characterized by swelling of the parotid gland and occasionally of the other salivary glands, and by constitutional symptoms, which are usually of a mild type. Mumps is less common than most of the other contagious diseases of children, and many escape it. It is endemic in all countries, but frequently occurs in local epidemics. It is most frequent between five and fifteen years, and is very rare in infants. It is contagious, but,

as a rule, close contact is required. It is rarely carried by a third person or by clothing, but this mode of communication is possible. Susceptibility of most children to mumps is not great. It is contagious from the very first symptoms and for several days after the swelling has subsided, but the exact period of contagion cannot be stated with certainty.

Both bacilli and micrococci have been discovered in liberal numbers in the swollen glands, but it has not been demonstrated that they are the primary cause of the disease. The period of incubation is variable, but is most commonly from seventeen to twenty days. Prevention consists in isolation of the patient for twenty days from the appearance of the first symptoms. This is the period usually required, also, for quarantine when the disease occurs in schools and institutions. If the room in which the patient is ill is freely open to the air, fumigation and disinfection are not required.

WHOOPING-COUGH

Pertussis, or whooping-cough, is a contagious disease marked by catarrhal symptoms and a peculiar and characteristic paroxysmal cough. It is a disease of early childhood, nearly one-half of all cases occurring during the first two years of life.

While in later childhood it is one of the milder diseases, in infancy it is serious and sometimes fatal. Broncho-pneumonia and convulsions are the chief complications. It cannot be said with certainty that the germ has been discovered, but it seems probable that further investigations will confirm the belief that Koplik's bacillus is the specific cause. The lungs appear to be the seat of invasion, and the catarrhal stage which always precedes the appearance of the paroxysmal attacks represents the period of the growth and development of the bacilli.

Whooping-cough is very contagious from the very beginning of the catarrhal stage, but it is difficult to speak as positively as to the time when it ceases to be contagious. It is certainly so during the entire spasmodic stage, and probably longer. Isolation from other children is often necessary for twelve weeks. A peculiar spasmodic cough sometimes occurs weeks after the disease has subsided. It may be brought on by slight exposure to cold or by choking. This cough is not contagious. It may appear at intervals during the whole winter if the child has whooping-cough in the fall.

The patient himself is usually the source of contagion. The disease is rarely transmitted by

clothing, by the room, or by the third person. The latter is possible, however, should a person who is in close contact with a sick child go at once to another child without a change of clothing. While the area of contagion is not great, the disease can be transmitted in the open air. Contagion is just as active in the interval as during a paroxysm, except, perhaps, that the germs may be blown a little greater distance from the patient.

The period of incubation is somewhat difficult of determination, owing partly to the usually insidious onset of the disease and the difficulty of determining in most cases the exact date at which it began. It probably varies from eleven to fourteen days, the average being twelve days. If sixteen days have passed after exposure without the occurrence of any cough, the disease has probably not been contracted.

Owing to the serious nature of whooping-cough in young or feeble children, greater caution should be observed in its prevention than it usually receives. Children with a predisposition to tuberculosis should be protected against exposure with particular care. As exposure usually results directly from the patient, prevention is not especially difficult. The chief point of difficulty lies in the fact that between the paroxysms the

patient is usually not very ill, and the long period of isolation becomes very irksome. Nevertheless, it is an unjustifiable invasion of the rights of others to permit a child suffering from whooping-cough to go into public places. He should be allowed to go into the open air as much as possible without mingling with other chlidren, and should not be confined to a single room. It is wise, therefore, when such an arrangement can be made, to send the other children of the family away from home. The seashore is an especially favourable place for children with whooping-cough. Unless it has been necessary to confine the child quite closely to one or two rooms, fumigation is not required. Thorough airing of the rooms is sufficient.

INFLUENZA

Influenza, or *la grippe*, is a contagious disease characterized by extreme prostration, and frequently by catarrh of the mucous membrane. Pneumonia is one of its most frequent and serious complications. It is one of the few diseases of modern times which has appeared in pandemic form. It has been known since the twelfth century. A marked peculiarity of its occurrence is its tendency to widespread epidemics, followed by periods of complete dissapearance. During the past century there were four severe epidemics in

this country. The last of these was peculiar in its marked persistence for several years after its acute onset. As a rule, it has died out in two or three seasons. Pandemics have all begun in eastern Russia or central Asia. In that of 1889, influenza was known to be present in eastern Russia in October. It reached Moscow early in November, and Berlin by the middle of the month. It appeared in London early in December, and in New York a few days before Christmas. No other modern disease is so rapid in its spread, and no other, except dengue, attacks so large a proportion of the inhabitants. Cases that appear in the early stages of the epidemics have usually been more serious than those of the last stages. One attack does not confer immunity, but the same individual may suffer time after time.

The germ of true influenza is the *bacillus influenzæ* of Pfeiffer. It occurs in large numbers in the discharges of the nose, throat, and bronchi. It is cultivated with difficulty outside the body, and is quickly destroyed by drying. It is very small in size, and does not produce spores.

Influenza is usually classed as pandemic, epidemic, and endemic. The pandemics are due to Pfeiffer's bacilli, and are true influenza. The epidemics, which for several years follow the pan-

demic, are also true influenza. The true disease may also occur endemically in sporadic cases. There is, however, a pseudo-influenza or catarrhal fever which closely simulates grippe. It is a specific disease, but is not due to the *bacillus influenzæ*, but to some other germ which has not been discovered. This pseudo-influenza occurs in sporadic cases or even epidemic form, and was seen by practitioners during the winter and spring months before the appearance of the last great epidemic. While true influenza occurred in epidemics for years after its appearance in 1889, most of the so-called cases of grippe since 1900 have been catarrhal fever rather than true epidemic influenza. The term grippe, however, has become firmly established, and to the patient it makes but little difference by what name it is called, for he is miserable under any name. While the feeling of wretchedness and prostration is common to all forms of the disorder, the after-results of catarrhal fever are less serious and prolonged than are those of true grippe. Pneumonia is less common, and the disease in subjects of ordinary strength is rarely fatal.

The extraordinary rapidity of the spread of epidemic influenza has led to the belief that it is conveyed by winds, but this has not been substantiated. The rapidity with which the germs

are destroyed by drying would seem to disprove this theory. These epidemics can usually be traced along the lines of human travel and communication. Many peculiar cases could be cited in which the disease was raging in a community while some public institution remained entirely free. Suddenly one case would be brought in from outside, when the disease would promptly break out and affect large numbers of the inmates. It must be said, however, that the occurrence of grippe in a few localities has not been satisfactorily explained as being carried by human agency.

Prevention during times of epidemic is extremely difficult. The disease is contagious from the first catarrhal symptoms, and sometimes earlier. It is so widely prevalent that there is no practical way of escaping it unless a person live a hermit-like existence. A large proportion of cases are "walking" cases, and there is no protection against them for those who go into public places. The disease affords some peculiar examples of personal immunity, some escaping it through epidemic after epidemic. The chief preventive measure for the ordinary individual is to maintain as good a condition of bodily health as may be possible. This apparently aids somewhat in preventing the disease, and is of material assistance in modifying its

severity and depressing effects upon those who contract it. Where there is a sporadic case, its spread may perhaps be prevented by isolation and the boiling of all articles which could have been soiled by the secretions of the throat or nose.

PNEUMONIA

Acute pneumonia appears under two different forms, lobar pneumonia and broncho-pneumonia. These two forms, while presenting many symptoms in common, have also some radical differences.

Lobar pneumonia, sometimes known as lung-fever or inflammation of the lungs, is the form commonly seen in adult life. It is an infectious, and perhaps transmissible, disease, but it is probably not contagious. Typical cases pursue the following course: The onset is marked by a severe chill, followed by a fever which continues with slight remissions five or seven days. In favourable cases the fever then falls abruptly and the case terminates by crisis. Cough, catching pain in the side, and panting respiration are usually present. Pneumonia is one of the few diseases that terminates with a definite crisis, but the exact hour or even the day on which this crisis may appear in any particular case can rarely be foretold. The term lobar has been given to this form of pneumonia because it involves complete

lobes of the lung. The right lung is divided into three great divisions or lobes, the left lung into two. At least one of these lobes becomes solidified by the filling up of the air spaces with inflammatory material. The seriousness of the disease results to but slight degree from local obstruction, but rather from the constitutional effects of the pneumonic poison.

Pneumonia in its different forms is the most widely spread and fatal of all the acute diseases. It occurs in all countries, but is most frequent in northern latitudes. In New York it is most common in February, March, and April. It attacks men more frequently than women, and is a particularly fatal disease among men in active middle life. It has greatly increased during the past ten years, due in large part to the numerous epidemics of influenza. It has been a frequent complication of influenza, and has been the direct cause of a great proportion of fatalities which have resulted from it. Observations made in the Massachusetts General Hospital show that there has been no increase in mortality from decade to decade in cases uncomplicated by influenza or similar conditions. The mortality increases with each decade of life, ranging from 3.7 per cent. under the twentieth year to 47 per cent. in the

fifth decade, and 65 per cent. in the seventh decade.

Of the predisposing causes, alcoholism is the most potent. Chronic users of alcohol are particularly liable to the disease, and in them it is especially fatal. Debilitating causes of all kinds tend to render an individual susceptible. This is particularly true of chronic diseases, like Bright's disease and diabetes. Pneumonia, in fact, is peculiar in being the most frequent of the "terminal diseases." Contrary to the common belief, many of the chronic diseases, and even some of the acute diseases, do not of themselves directly cause a large mortality. They terminate by one of the so-called terminal diseases, of which pneumonia is the most common. When the vital forces are reduced by chronic conditions the patient becomes particularly susceptible to acute infections. Chronic alcoholism, for example, rarely proves fatal in such a way that the cause is assigned to alcoholism in the death certificates. It commonly ends through a terminal disease, of which pneumonia, and disease of the kidney, liver, and arteries, are the most common. In speaking of chronic disorders, Doctor Osler has made the true but apparently paradoxical statement that people rarely die of the disease from which they suffer.

The germ of lobar pneumonia is the *micrococcus lanceolatus*, sometimes known as the pneumococcus of Fraenkel. In rare cases other germs may cause this type. The pneumococcus is a germ of low resisting power, and is easily destroyed by heat and disinfectants. It is cultivated with difficulty, but is pathogenic for white mice and rabbits, so that it has been possible to study its habits and methods of action. It is a widespread organism, and is frequently found in the throats of healthy people. It has long been a popular belief that exposure to cold or chilling of the body is a potent cause of pneumonia. It is certainly not a necessary cause, for in a majority of cases no history of such chilling can be obtained, while, on the other hand, exposure occurs hundreds of times without resulting in pneumonia. A chill, by causing a congestion of the mucous membranes and the removal of the protecting cells from their surface, may render it possible for pneumococci to gain a foothold. A single experiment explains much in this direction. Pure cultures of pneumococci were injected into the lungs of healthy rabbits with the result of causing nothing more than temporary irritation. Rabbits exposed to the fumes of ammonia gas until their bronchial membranes had become irritated and congested, were then treated in the same

manner and promptly developed pneumonia. Observations of this character, as well as every-day experience, confirms the belief that some of the common predisposing causes are active factors in precipitating an attack.

The germ of pneumonia maintains its vitality for long periods of time in such elements as sputum and blood. When sputum containing them has been dried and converted into powder, they have been found to be virulent for as long as forty-five days. It seems probable, therefore, that pneumonic sputa which has become dried and pulverized may disseminate the disease as sputa containing the germs of tuberculosis disseminate that disease. It is at least certain that the germs appear to be derived from a place rather than a person, unclean houses being especially adapted to their growth. During the construction of the new New York City Croton Aqueduct an epidemic of pneumonia broke out in several houses in which gangs of men were quartered. Upon the removal of the men to other places it ceased, but on their return to the same houses it reappeared, to disappear upon their again being removed. The pneumonic germs were found in large numbers in the rooms of these houses. Reports are numerous of the same experience in

prisons, almshouses, and other places. Pneumonia most frequently occurs in those who live much in the house and little in the open air. It is not necessary to isolate the pneumonia patient, nor is fumigation or other measures of like nature required if proper precautions have been taken in the disposal of the sputa. As it seems clear that the chief mode of dissemination is by the sputum, it should be cared for with the same precautions as were directed for the care of tuberculous sputa. The attendants should be particularly careful in the washing of their hands and in all other details of cleanliness.

Broncho-Pneumonia.—This form of pneumonia is essentially a disease of young children. It is sometimes called catarrhal or lobular pneumonia. The latter term is used because the disease involves not a whole lobe of the lung, but scattered lobules. It does not pursue as clear-cut and definite a course as does lobar pneumonia. It may pass away in a few days or continue day after day for weeks, extending from one portion of the lung to another. It rarely begins abruptly, but is slow in its onset, and frequently follows bronchitis. It terminates gradually, a crisis being rare. More commonly it runs its course in from one to two weeks, but sometimes continues for four weeks or longer.

Broncho-pneumonia may appear as a primary or secondary disease. By the first of these terms is meant that it occurs independently without any preceding disease. By the second is meant that it follows or complicates some other disease, usually an infectious one. It may be secondary to the following diseases, mentioned in the order of their frequency: measles, whooping-cough, diphtheria, bronchitis, acute diarrhea scarlet fever, and influenza.

Broncho-pneumonia is not as distinct an entity as is lobar pneumonia, but may be the result of the action of various germs. In primary cases the pneumococcus is nearly always present, and usually occurs alone. The secondary cases are commonly mixed infections, for streptococci and the bacillus of Friedlander are often present. This is quite to be expected when it is known that the disease is so frequently an accompaniment of the infectious diseases. As explained under the head of septic infection, streptococcus infections are apt to be widespread, and very resistant to treatment. Following this principle, streptococcus pneumonias are prone to be prolonged and cause the death of the child by exhaustion. Pneumonia of this type sometimes continues week after week, with improvement in one locality only, to be

followed by the lighting up of a new focus in another. Among babies and young children broncho-pneumonia is a very grave and fatal disease. The most experienced physician cannot foretell with certainty the course which it will take, for a new focus may suddenly develop without warning. They are among the most trying diseases for physicians owing to this characteristic of uncertainty, and also to the fact that the portions of the lung involved may be so scattered that it is difficult to detect them by physical examination.

The bacillus of tuberculosis is capable of producing broncho-pneumonia which cannot in the early stage be distinguished from types produced by other germs. It is one of the most common forms of tubercular onset. Broncho-pneumonia sometimes occurs among the aged, and is not an infrequent terminal disease in the late decades of life. A type of pneumonia sometimes known as senile pneumonia is one of the most common causes of death among the aged. It is insidious in its onset and development, and produces few of the typical symptoms commonly seen in earlier years. There may be little or no cough, expectoration, or pain.

Measures of prevention required for broncho-

pneumonia are virtually the same as those suggested for lobar pneumonia. Rickets and malnutrition render a child especially susceptible to pneumonia; the most serious and fatal cases are those which occur among poorly nourished infants. They do not, however, hold a monopoly upon the disease, for it not infrequently occurs without warning and apparently without reason among the healthiest and most perfectly nourished children. The outcome in such cases, however, is usually much better than among the ill-nourished.

PLEURISY

Pleurisy is an inflammation of the pleura, and usually results in a collection of fluid in the pleural cavity. The pleura is the lining membrane of the chest wall, from which it is reflected onto the surface of the lung. It thus forms a cavity, the walls of which lie in apposition. It is a polished membrane designed to prevent friction between the chest and the lung in breathing. It corresponds to the peritoneum in the abdomen. In health it is moistened by a slight secretion of serum. When inflamed, this secretion is increased, and having no exit from the pleural cavity, it must collect. The amount often becomes large, and as a result the lung is compressed into the upper part of the chest. At the outset the rubbing

together of the surfaces causes agonizing pain, but later, when the fluid has separated them, the pain ceases. When the fluid consists of serum alone it is often absorbed after the inflammation has run its course. In some cases a portion must be drawn away through a hollow needle, when the rest will be removed by absorption.

Sometimes the fluid in the chest is pus. This is a very grave condition, for the pus will never be absorbed, and general infection and exhaustion follow if it is allowed to remain. This condition is known as empyema. It is more common in children than in adults. In early life it rarely occurs except as a sequel to pneumonia. It is then caused chiefly by the pneumococcus, alone or accompanied by the pus-forming germs. In adults empyema is commonly due to streptococci or tubercle bacilli. The only adequate treatment is removal of the pus by an incision through the chest wall and the insertion of a drainage tube. This operation should be performed as soon as the diagnosis is made. When performed early, before the lung has been long compressed and the strength of the patient has been exhausted, the death rate is small. When it is delayed, the death rate is very large, and recovery, if it takes place, is slow and tedious. Deformity of the

chest rarely takes place after early operation, but is common when it has been delayed.

The bacteria which cause pleurisy and empyema reach the pleura by way of the lungs. The prevention of pleurisy, therefore, consists in excluding bacteria from the bronchial tubes and lungs, particularly those which cause tuberculosis, pneumonia, and bronchitis.

MENINGITIS

Meningitis is an inflammation of the meninges, or envelopes of the brain. It is sometimes, in popular language, referred to as brain fever, or inflammation of the brain. Inflammation of the brain itself is a rare condition. Meningitis in its various forms is not uncommon. It is a complex and difficult subject to describe clearly. The acute disease results from various causes. First, it occurs as an epidemic disease known as epidemic cerebro-spinal meningitis, or spotted fever. Second, it occurs in sporadic cases, and runs a course almost identical with that of the epidemic disease. Third, it is sometimes caused by the bacillus tuberculosis, in which case it runs a characteristic course which always terminates fatally. Fourth, it sometimes occurs as a complication of typhoid fever, pneumonia, scarlet fever, smallpox, and other infectious diseases. In such

cases it is caused by the action on the meninges of the germ which causes the original disease. Fifth, it may result from an extension of inflammation from adjoining structures. It thus sometimes follows inflammation of the middle ear or injury to the bones of the head. Sixth, there are a few cases in which meningitis seems to be due to exposure to wet or cold, but such cases are no doubt also due to some form of germ infection.

Epidemic cerebro-spinal meningitis is usually due to the *diplococcus intracellularis*, so called because it is a double germ which is found within the body of the pus cells which form on the inflamed membranes of the brain and spinal cord. The first extensive epidemic occurred in this country in 1806, the last during 1876. Since that time it has been endemic in most large cities. A peculiar feature of the disease is its tendency to appear simultaneously in a number of individuals, and not by person to person extension. Epidemics often appear in widely separated communities. The disease varies considerably in its severity in different epidemics. A virulent type may appear at one time, while at another it may be comparatively mild. The mortality ranges all the way from 25 to 70 per cent.; it is more commonly above than below 50 per cent.

Epidemic meningitis is a disease of childhood and early adult life, being rare after thirty years of age. While it is somewhat more common among the poorer classes of large cities, it occurs also among the wealthy. But little has been discovered regarding the mode of infection or the portal of entrance of the specific germ, although many excellent observers have made these questions a study. The diseased tissues are enclosed within bony cavities, and the route along which the germs must pass to gain admission to them is not wholly clear. It is probable that they enter through the tonsils or tissues at the back of the throat, from which the passage by way of the lymphatic vessels is short. In view of the location of the disease, it would seem doubtful whether it could be conveyed by contact from one to another. Observation, in fact, seems to show that it is not contagious, although in rare cases more than one member of a family suffers from it. Such cases are probably infected from a common source. As it is probable that the disease is not transmitted from person to person, rigid isolation does not seem to be necessary. As the methods of transmission are uncertain, however, it is a wise precaution to keep children and young adults from contact with those who are ill. As the

bacilli are contained in the pus cells, any purulent discharge from nose, ear, or other locality should be disinfected, and all articles soiled with them should be burned or disinfected.

The cases of cerebro-spinal meningitis which occur sporadically are occasionally due to the germ which causes the epidemic variety, but a certain form of streptococcus and the pneumococcus are the bacteria most frequently found. Such cases show no tendency to epidemic occurrence. The symptoms are very similar to those of the epidemic form. It is not contagious, nor is it, as a rule, so often fatal as the epidemic variety.

RHEUMATISM

Rheumatic fever is an acute, non-contagious, infectious disease, characterized by inflammation of several joints of the body, having a peculiar tendency to pass from joint to joint. It is self-limiting, but pursues a somewhat variable course. It is a disease of temperate climates, and is most common during the spring months. It is endemic in most cold and damp climates, but appears in indefinite epidemics at irregular intervals. It affects young adults chiefly, about half of all the cases occurring between the ages of fifteen and twenty-five years. After forty-five acute rheumatism is not common. It should be understood

that we are now considering "inflammatory rheumatism," and not the so-called muscular or chronic rheumatism common to middle and later life.

The infective agent has not been discovered, but analogy leads very strongly to the belief that such an agent exists. It seems to be allied with the septic diseases, and shows many characteristics of septic infection. The more accurate methods of observation of recent years eliminate many disorders which were formerly known as rheumatism. Some of these, like chronic deforming rheumatism, are in no sense rheumatic in their nature, while others belong to the gouty family. The term "rheumatism" is properly applied to those acute and subacute conditions which are marked by involvement of the joints and fibrous structures, and have a tendency to involve certain of the internal organs, notably the heart. The rheumatic group of diseases includes not only rheumatic fever, but tonsilitis, St. Vitus's dance, certain forms of skin eruptions, and acute disease of the heart.

Heredity is a strong predisposing factor, being an active element in at least two-thirds of the cases in early life. Exposure to cold and wet, and living in damp dwellings under poor hygienic surroundings, with insufficient food, are among the predisposing

causes. A cold, damp climate with clayey soil also predisposes it. As but little is known of the exciting cause, prevention consists chiefly in the elimination of the disposing cause as far as it is possible.

Much may be done to prevent the occurrence of the disease in the children of rheumatic families. The management of these rheumatic children (for where the family is strongly rheumatic the child is very prone to be) is included under four headings: clothing, exercise, diet, and medication. The rheumatic child should wear flannels at all seasons, though during the summer it may be of thin texture. Its value as a means of prevention has been too well established to be doubted. As the belief is growing that the tonsils form at least one portal of entry for the rheumatic poison, another reason is added to many for removing the enlarged portion of those organs when they are diseased. The exercise and outdoor life of the rheumatic child should receive particular attention. There is a strong tendency on the part of mothers to confine their children too closely to the house, thus rendering them the more susceptible to cold. On the other hand, there are many days during the winter and spring in which a child of rheumatic tendency should be kept in the house. Days of

damp east wind, particularly if the ground be covered with slush or melting snow, are especially favourable for the development of rheumatism. Here, as in so many other places in the management of children, the golden mean is the middle course between too much coddling on the one hand and too much exposure in foolish attempts at hardening on the other.

The diet of the child or the adult of rheumatic tendency was formerly looked upon as of more importance than it is at the present time. When the acid theory was more generally held, and when the difference between rheumatism and gout was not as well understood, it was natural that diet should be looked upon as of utmost importance. We should not, however, go to the other extreme and neglect it. It is not necessary to wholly eliminate meat and other nitrogenous food from the diet of rheumatic subjects, though it is wise to reduce it if there is a tendency to take it in excess. Restriction should rather be made in the direction of sugar and starches. A diet consisting largely of starches and overcharged with sugar is the worst possible one for a rheumatic child. Candy should be absolutely forbidden. The rheumatic child is prone to be anemic, and a plain but generous nourishing diet which contains no one food element

in excess is the best. It is to be understood that this advice is given for those subject to rheumatism, and not to those of gouty families or for elderly people with a strongly marked gouty and uric acid tendency.

Rheumatic subjects, particularly children, become readily anemic, and one of the most potent measures of prevention is the maintenance of nutrition and the prevention of anemia. Those children of rheumatic tendency who are prone to be anemic should receive, in addition to particular personal care and good diet, certain tonic preparations at regular intervals. They may thus take a mild preparation of iron. Cod-liver oil is of particular value to such children. It may often be given with great advantage for one, two or three weeks of each month during the cold weather. For children, cod-liver oil should be regarded as a food rather than a medicine. In those of pronounced rheumatic tendency the importance of nutrition-improving treatment cannot be too strongly urged as a preventive of acute attacks.

The most serious aspect of rheumatism is its tendency to affect the heart. Most of the valvular heart disease of middle life is due to rheumatic attacks during childhood and youth. At that time of life the disease is peculiar in that the joint

symptoms are prone to be slight while the tendency to heart complication is great. No rheumatic attack in a child is so slight as to be free from possible danger. Even in the mildest attacks, the child should be kept absolutely in bed until every symptom has passed. This is the most potent preventive measure that can be taken against that grave condition—valvular heart disease.

MALARIAL FEVER

The term malarial fever is used to designate several forms of disease which result from the presence in the blood of an animal parasite discovered by Laverlan and known as the *plasmodium malariæ*. These fevers appear under two general forms—intermittent and remittent. The intermittent fevers are most characteristic, and when fully developed appear in paroxysms consisting of a chill, fever, and sweating. This order is always maintained. The occurrence of these three symptoms in different order is the result of some disease other than malaria. Intermittent fever appears in three general types. When the paroxysm occurs every day the disease is known as the "quotidian"; when it occurs every other day, as "tertian"; when it occurs every third day, as "quartan." The last form is rare in northern climates. Quotidian fever is most commonly seen in children;

tertian is the type common to adults. In remittent fever, the temperature falls between the paroxysms, but does not reach normal, as in intermittent.

In northern latitudes malarial fever is rarely fatal, but in tropical regions it often assumes a pernicious type which is deadly. When the infection is intense, the paroxysm comes a little earlier each day, and is known as "anticipating." In this way a tertian, if untreated, may become quotidian in type. The most malignant forms of malarial fever are seen along the sea coast of tropical countries. It is particularly prevalent in low-lying and swampy regions. Marshes that are alternately flooded and drained imperfectly are usually malarial. Salt marshes of this character form some of the most dangerous regions known. The great number of cases of malarial fever, however, as pointed out by Sternberg, do not result from exposure to the air of marshes, but from damp bottom-lands, from alluvial plains under cultivation, and from the margins of streams which are exposed during the dry season. This results naturally from the fact that malarious marshes are shunned, while the rich lands of the valleys are sought for agricultural purposes. Notwithstanding the tendency of malaria to originate

from marshes and low, wet ground, the rule is not invariable. Certain regions which apparently present every condition for malarial development are non-malarial. It has long been observed that a wind blowing from an unusual direction sometimes carries malaria into a region where it is rarely known.

Many of these peculiarities in the development of malaria were difficult of explanation until the rôle of the mosquito in disseminating the plasmodium was demonstrated in very recent years. The micro-organisms concerned in the production of malaria is not a bacterium, but a member of the lowest order of the animal kingdom. It belongs to the protozoon class, a parasite which multiplies by means of spores. It is found in the red cells of the blood. Each plasmodium passes through a certain life cycle. It begins as a small structureless body, and fine brown granules of pigment gradually appear on its centre. The plasmodium grows until it completely fills the red blood cell, the substance of which it absorbs for its own nutrition. The pigment granules then begin to collect in groups near the centre, and the whole body shows faint striations. These become deeper, until the original body is almost divided into segments, numbering from five to twenty,

according to the variety of plasmodium. Just before segmentation these bodies are regularly arranged and appear under the microscope like little rosettes. Separation is completed, and each segment starts on a new cycle of life, to pass through similar stages of development. There are several varieties of the plasmodium family, which produce different types of malarial fever. Quotidian fever, in which the paroxysms occur daily, is due to two sets of tertian parasites, each set running its life's course in forty-eight hours, but maturing on alternate days, thus causing a daily paroxysm.

The malarial paroxysm occurs at the time of segmentation of the parasites. So invariable is this rule that an expert examining the blood can tell, almost to the hour, the time at which the paroxysm will occur. The commonly accepted explanation of this is that a poison is eliminated at the time of segmentation. It is this poison which causes the peculiar combination of chill, fever, and sweat. As a rule, a large number of parasites segment at about the same time and eliminate suddenly a large amount of poison, which produces a paroxysm. The poison, being excreted from the body or being destroyed, the patient returns to his usual health. After a short time, however, the destruction of the red blood

cells produces anemia; the effect of the poison becomes less transient, and the patient passes into a peculiar anemic state known as cachexia. If the parasites segment at varying intervals, we get a more or less continued fever. If a majority of them segment at a given hour, while a considerable portion of them segment at irregular intervals through the remaining part of the day, we have a remittent fever in which the temperature fluctuates but does not return to the normal point. A dose of quinine administered shortly before the paroxysm is followed by sluggishness or actual death of the parasites. They fail to segment, and if the dose has been sufficiently large no paroxysm occurs. Many of the spores, however, survive, and after a time a sufficient number of parasites have developed to bring about another paroxysm. The spores are very tenacious of life, as are all spores, and repeated doses of quinine are necessary for their complete destruction. It has been observed that certain forms of plasmodium are less susceptible to the effects of quinine than are others. This is particularly so in those forms which segment at irregular intervals and thus cause an irregular or continued type of disease.

Many of these facts, particularly the effect of quinine, were known before the discovery of the

plasmodium. Very few scientific discoveries have so beautifully explained the cause of well-known phenomena. Increased knowledge of the plasmodium and its mode of transmission explains more and more fully the various peculiarities of these particular diseases. Adding of the last links to this chain of knowledge regarding malaria has been the work of very recent years. After the discovery of the plasmodium, the mystery as to the spread of malaria was even greater than before. It was clear that the infective principle was not a "miasm," or vapour, nor even a light germ that could float in the air when dry, but a comparatively large, heavy, moist body, which could not be expected to float. And yet it was clear that the infection came through the air. There was abundant proof in many cases that it could come in no other way. It was demonstrated by experiment that the parasites could not enter the blood by way of the stomach. Water and food containing them were innocuous when swallowed. With increasing knowledge, the fact became more plain that the disease, in some places at least, must be transmitted by insects, and the mosquito was finally found to be the criminal engaged in the nefarious occupation. It was soon found that the ordinary mosquito, although a pestiferous insect, could not be

charged with this more serious crime, but only the genus known as the *Anopheles*, especially the species *Anopheles claviger.*

There are about thirty kinds of gnats indigenous to this country. The term "mosquito" is popularly applied to but one variety of this group, namely the *Culex.* The following are the more important differences between the Anopheles and the Culex: The Anopheles is of slender build, the body is almost straight, and the wings are marked by dark spots. When the insect alights, its body rests at an angle of about forty-five degrees with the plane of the surface on which it is resting. That is, it is a straight insect with its body elevated in the air. The Culex is of heavier build, and is decidedly humpbacked. The wings have no spots, and when the insect alights its body is almost parallel with the surface upon which it is resting.

It is well known that gnats generate in water or in damp places. The eggs are deposited upon water, and when they hatch, larvæ develop. These larvæ may be seen by the naked eye as little, active, rod-shaped bodies of brownish colour. They move about with a wiggling motion near the surface, but when disturbed they instantly seek the bottom. The larvæ of the Culex dive directly downward with a quick motion, while those of the

Anopheles glide downward with an oblique sliding motion. After a few days these larvæ are transformed into pupæ, which in turn develop into mature gnats. About a month is required for the development of the mature mosquito after the eggs are deposited.

The mosquito transmits malaria by sucking the blood of a malarial subject. The parasite is then taken into the stomach of the insect. After several changes it passes into the salivary glands, where it remains till the mosquito bites its next victim. It is then injected into the tissues of the individual upon whom the mosquito is feeding. Having once become infected, the disease is perpetuated in the Anopheles family of that particular locality. Many interesting facts regarding the mosquitoes of the United States are contained in Bulletin No. 25 of the new series of the United States Department of Agriculture.

The reason why some marshy and low-lying grounds are not malarial has been made clear. In every such case which has been investigated the Anopheles has been conspicuous by its absence, although other forms of mosquitoes may have been abundant. The conveyance of malaria by winds and at long distances from malarial regions is readily explained by the fact that the Anopheles,

which are ready travelers, are blown along, bearing with them their stock of plasmodia. In fact, few of the previously obscure questions now lack for an explanation.

In the light of our present knowledge, it may be positively stated that malaria may be transmitted by the agency of mosquitoes of the Anopheles species. It may be said with almost equal certainty that this is the only method of conveying the disease. These facts are confirmed by many well-known tests. A son of Doctor Manson, a healthy man who had never had malaria nor been in a malarious region, allowed himself to be bitten in England by infected mosquitoes brought from Italy. In a few days he came down with a sharp attack of malaria, and plasmodia, which were not present in the blood before, were found in abundance. Men protected by screens live in malarious regions with impunity, and sleep night after night in localities where it has been regarded as almost certain death to remain after dark. In that very dangerous region, the Campania, Doctor Sambron and a friend spent the nights from June to September, 1900, in a well-screened hut, and escaped infection. In Havana, in the campaign against the yellow-fever-bearing mosquitoes, all mosquitoes were killed as far as possible and their

breeding places were destroyed. In 1900, the year previous to the mosquito work, there were 344 deaths from malarial fever. In 1901, the first year of the mosquito work, there were 151 deaths, and in 1902 only 90. A battalion of Japanese troops in Formosa was protected from mosquitoes for 161 days during the malarial season and entirely escaped the disease. An unprotected battalion in the same place developed during that time 259 cases of malaria. These are but a few of many similar proofs.

The efficacy of the simple precaution of screening has become so well known that it is being employed on a large scale in many malarious regions. The Anopheles bites only at night. Theoretically, the methods of protection are simple. Practically they are, in many regions, very difficult to carry out. The Anopheles are inclined to deposit their eggs in natural pools and puddles which do not become dry quickly. They seem to select water which contains green water plants, unlike the Culex, which is prone to select pools, cisterns, or collections of water near human habitations.

From the study of the habits of the Anopheles it is clear that the most feasible method of extermination is by preventing the development of the larvæ. They may be most easily reached by

seeking them in their habitat while in that state of development. The drainage of all pools and puddles, therefore, so far as it is practical, should be the first measure taken. Although the disease-producing insect does not commonly seek temporary collections of rain water near houses, such collections should not be permitted to remain. Bodies of water which cannot be drained may be made free of larvæ by sprinkling the surface with petroleum or some other light oil. The oil quickly spreads over the surface and prevents the larvæ from getting access to the air, as it is for this necessary purpose that they come to the surface. A half teaspoon of oil to a square yard is an ample amount. Fish eat the larvæ, and in larger bodies of water where the use of oil is undesirable much may be done in prevention by stocking the water with fish. In damp and marshy regions draining is the proper measure to apply. In many localities simple means are ample for the prevention of malarial infection. The methods necessary to attain success in this work are admirably described in an article in the *Century Magazine* for July, 1902, upon the operations at Oyster Bay, Long Island, where the conditions were almost hopeless. In regions where such measures cannot be employed the most important measure is thorough screening

of all doors and windows, with the additional precaution of mosquito bars for the beds, for it is chiefly at night that the mosquito does its work. The houses should be as high above ground as possible, and the sleeping-rooms should be in the upper part of the house, for the Anopheles fly low. In markedly malarious regions seclusion behind screens between sunrise and sunset is an important measure. The female Anopheles hibernates, and selects for this purpose the eaves, cracks, and corners of outhouses and barns. As these will be the progenitors of next year's race, their destruction is important. Much may be done in this direction by fumigating rooms and houses with sulphur, and applying whitewash to outhouses.

It is obviously important to debar the malaria-bearing mosquito from the chief and perhaps only source of supply—the blood of a malarial patient. The malarial patient is almost as dangerous to the community as is the mosquito, although his disease is not contagious. Not only should he be kept behind screens while his blood contains the plasmodium, but he should be vigorously treated with quinine. This should be given not alone for the good of the patient, but as a means of preventing the spread of the disease to others. It should be continued until the parasite has disap-

peared from the blood, and for at least three days in each week for six or eight weeks, to make certain that particularly obstinate spores have been destroyed.

YELLOW FEVER

Yellow fever is an acute, transmissible, infectious disease, but is not contagious. It is characterized by jaundice, hemorrhages, vomiting of dark or black matter, and high fever. It is prevalent in the West Indies, the Mexican portion of the Gulf coast, and the Guinea coast. In other regions of the tropical Atlantic coast it appears in periodic epidemics, and in still more distant regions in occasional epidemics. It has thus appeared as far north as Halifax.

A germ known as the *bacillus icteroides* was for a time believed by some observers to be the exciting cause, but this is not the fact. It is probable that the specific germ is not a bacterium, but a member of the animal kingdom, similar to the plasmodium of malaria. In few other diseases have recent investigations so completely changed our beliefs. It was believed for many years that yellow fever was transmitted chiefly by fomites—that is, clothing, bedding, etc. Although it had been thought by many that it was sometimes transmitted by insects, it was only within the

past two years that this was absolutely demonstrated. It was at first supposed that this was but one means of transmission. It is now held by some of the best authorities that it is the only means, and this belief seems to be well borne out by experiences in Havana. Those experiences are so remarkable and the results so extraordinary that they are worthy of record.

The following facts regarding the stamping out of yellow fever in Havana are derived from a statement recently made by Doctor W. C. Gorgas, Chief Sanitary Officer of Havana during the American occupation. "Yellow fever had been endemic in Havana for 150 years, during which time there had never been a month in which the city was free from it. At the time the Americans assumed control the general death rate was 91.03 per 1,000 of population. In 1899 it fell to 33.67, and in the two following years to 24.40 and 21.00. Notwithstanding the improvements made in the sanitary condition of the city, and the decrease in the general death rate, yellow fever had only been slightly affected. An epidemic occurred in 1899.

"The belief was then gaining ground that it was conveyed by mosquitoes, and the evidence was being narrowed down to show that the Culex mosquito (*Stegomyia fasciata*) was the offender.

Orders were accordingly issued that every case should be screened. This was done at public expense. Screens were placed at windows and doors within two hours after a case was reported. A force of men was immediately put to work, and all mosquitoes in the house and vicinity were killed. At the same time a hundred men were employed cleaning the streets, draining the pools, and putting oil into cesspools and all damp places that could not be drained. Yellow fever began immediately to abate, but still disinfection and fumigation were continued. It was found that the inconvenience caused by these latter procedures prevented the reporting of some cases, and as knowledge grew they were believed to be unnecessary. Hence, all disinfection of clothing, bedding and rooms, and fumigation was stopped, and the rigid quarantine of the patient was stopped. It was merely required that the patient should be reported, his house placarded and screened, and a guard placed to see that the screens were kept properly in place. During the summer of 1901 the disease rapidly subsided, and the last case developed on September 28th." Doctor Gorgas, speaking in New York in November, 1902, said that no case had developed in Havana since that time, a period of fourteen months. For the ten years preceeding

1899, the average number of deaths from yellow fever in Havana had been 410, with a maximum of 1,175 in 1896. In 1901 there were five deaths before September, notwithstanding the fact that there were more non-immunes in the city than ever before.

It is known that infected mosquitoes may survive and continue dangerous for long periods of time—sufficient, indeed, to account for their carrying the disease from place to place. They may thus take an ocean voyage and arrive vigorous and well at their destination. In thus obliterating the chief source from which yellow fever is periodically imported into this country, the saving in money and human life to the United States will in a few years more than equal the money and life expended in the war with Spain. The epidemic of 1878 cost this country fully $100,000,000. As Rio Janeiro is now the only endemic centre on this continent from which yellow fever is spread to other places, it is reasonable to expect that the disease will soon be but a memory of the past.

ASIATIC CHOLERA

Cholera is an infectious, transmissible, but not contagious disease, characterized by fever, violent vomiting and purging, and rapid collapse. It has for ages been endemic in India, whence it

extends at intervals in more or less widespread epidemics. Its excursions out of India have been strikingly similar. The western invasions have taken three routes, more than one at a time being sometimes utilized. The first of these routes is through Persia and central Asia to Russia; the second, by the Persian Gulf through Arabia and Turkey to Constantinople and up the Danube; the third, by way of the Red Sea to Aden and Mecca and thence to Egypt and the countries of the west. The route by Mecca is particularly dangerous. It is brought by the pilgrims to that sacred city, and is distributed broadcast at the sacred well and other holy places, where religious bigotry prevents sanitary regulations. The returning pilgrims thus scatter it through the Levantine and Egyptian cities. From these regions it is but a step to Europe and America.

During the nineteenth century there were seven distinct invasions of Europe. The last, which occurred in 1891, was particularly ominous because of the unprecedented rapidity with which the disease traveled. This, of course, was due to increased facility of human intercommunication, and is a warning that each future invasion will for that reason be more difficult to control. The last appearance of the disease in the United States

was in 1873. Cases reached New York in 1892, but with the exception of three or four doubtful cases, it was stopped at quarantine. As the last two European invasions occurred at intervals of twelve years, and as the longest interval during the past century was fifteen years, it is not unreasonable to expect that another western invasion will occur in the not distant future. The epidemics in Egypt and the Philippines give evidence, in fact, that the disease is again bestirring itself. On July 25th it broke out in Astrakhan, but the number of cases was not large. Epidemics usually occur in the warm months, and in northern latitudes disappear during the winter. This, however, is not an invariable rule.

Cholera is caused by the bacterium known as the *spirillum choleræ*, more commonly called the comma bacillus, because of its resemblance to that punctuation mark. It was discovered in 1884 by Koch, who had been sent to India by the German Government. It is a germ presenting many peculiarities. It belongs to the facultative group of bacteria, and develops in a suitable medium outside the body almost as well as in the intestinal canal. It will live for months in a moist medium, but quickly perishes when dried. This is an important fact. When infected secretions are dried in a thin layer,

the spirillum loses its vitality after two hours. In thicker layers and on threads and cloth it lives much longer. It is not exhaled by the breath, and cannot circulate in the atmosphere in a moist condition. The disease is not, therefore, conveyed by the air, and is not contagious. There is no danger from letters which come from a region where cholera prevails, unless they have been actually soiled by choleraic discharges. Even in that case the thorough drying they undergo would probably destroy the germs.

Cholera is only contracted by taking the germs into the stomach. They may be carried directly to the mouth by the hand or unclean dishes, but they more frequently enter with contaminated food or water. With a pure water supply epidemics rarely become uncontrollable. The germ is not affected by cold, but is killed by heat, so that thorough cooking is a sure safeguard. It is sensitive to acids, and is destroyed by the acid secretions of the stomach when they are in a normal condition. The administration of acids after eating is therefore rational preventive treatment. The seat of activity of the sprillum is the intestinal canal. It is conveyed from the patient only in the intestinal discharges. In rare instances it has been found in vomited matter. It is easy to understand why

the disease prevails among the filthy inmates of the steerage and rarely attacks the cleanly passengers of the cabin; why nurses and physicians may come in daily contact with cholera in well-regulated hospitals and escape infection. They keep the patients scrupulously clean, and immediately disinfect and remove the discharges; they use water which has been boiled; they eat clean cooked food from clean dishes; they cleanse the hands frequently and keep them away from the mouth.

The importance of a pure water supply for cities was graphically shown by the experience in 1892 of Hamburg and Altona, two cities lying side by side. Both take their water supply from the River Elbe. Altona passed it through sand filters before allowing it to enter the city. There were 34 cases of cholera to each 10,000 of population, and many of these were brought over from the adjacent infected regions of Hamburg. Hamburg used unfiltered water, and during the same time there were 246 cases to the 10,000 of population.

The only portal of entrance for the comma bacillus is the alimentary tract. Ernest Hart's aphorism applies equally to cholera and typhoid fever: "You can eat cholera and you can drink cholera, but you cannot catch cholera." Prevention may be summed up in one word—cleanliness.

Improper food alone can never cause cholera, but by disturbing digestion may predispose it. Good general health and perfect digestion confer immunity to a very appreciable degree. It is particularly prone to attack the intemperate and those debilitated by bad surroundings and want of food. When the disease is prevalent, nothing but freshly cooked food should be used, and water and milk should be boiled. The hands should be washed and disinfected before eating. Flies and other insects should be prevented from gaining access to the food. As cholera is spread much the same as typhoid fever, it should receive the same precautions and care.

The preventive inoculation of Haffkine certainly shows encouraging results. Among about 200,000 cases inoculated, there were but 1-19 as many cases and 1-17 as many deaths as among those not receiving the treatment.

As the period of incubation is rarely more than five days, proper precautions at quarantine render it possible to prevent the introduction of cholera into America. A person infected before leaving a European port would develop symptoms before his arrival here. In case of a general European epidemic, however, it would require the most extreme caution to prevent its gaining a foothold

in this country, for mild cases might slip past the most watchful health officers. The denunciations of the Health Office of New York which kept it out in 1892 would be mild to what would fall upon one who should let it pass.

THE PLAGUE

The plague, next to leprosy, was the most prominent disease in the history of the past. It is variously known as bubonic plague, Oriental plague, Justinian plague, and black death. The latter name is given because of extensive hemorrhages which occur under the skin. It is characterized by high fever, inflammation of the lymphatic glands, hemorrhages, and brain symptoms. Its mortality is high. It is a filth disease in the sense that its occurrence and dissemination are accelerated by overcrowding, filth, poor food, and intemperance. No one of these, however, nor a combination of them all, will cause the disease without the presence of the specific bacillus.

Its home for centuries was in northern Africa, from which at intervals it issued forth in world-wide epidemics. One of the first of these great epidemics occurred in the reign of Justinian, in the sixth century, from which it derived one of its names. The black death of the fourteenth century was one of the most dreadful of its visitations to

Europe. During that epidemic it was estimated that it destroyed 25,000,000 people, a quarter of the entire population of western Europe. In those early times diseases were poorly differentiated, and it is probable that during some of these worst epidemics the plague was accompanied by malignant typhus fever and perhaps the malignant forms of other contagious diseases. The unsanitary modes of life of those early times would make their occurrence quite possible. During the Great Plague of London in 1665 there were 70,000 deaths in a single year in a population of less than a million. Two-thirds of the people fled; the panic and terror can hardly be comprehended.

The plague appeared at Hongkong in 1894. From that city it spread rapidly toward the East, and has since been epidemic in India. Within nine months after its appearance in Bombay it caused 20,000 deaths. It has extended to other parts of the world in localized epidemics. A few cases occurred in Glasgow in 1900 after an absence from the British Islands of more than 200 years. It reached quarantine in New York in 1899, but was there stopped. There has been an epidemic among the Chinese in San Francisco, 59 cases having occurred up to July 15, 1902. The occurrence of so many cases was unnecessary and

unjustifiable. The whole country has a just grievance against the health authorities of that city, who long refused to acknowledge its presence and take the necessary precautions against its spread to other places.

Sanitary conditions have so large an influence upon the spread of the plague that it is doubtful whether it could reach very formidable proportions in this country. Still it might become a very grave danger were it to occur in tenement populations. At Hongkong the death rate among the Chinese was 93 per cent., among the Japanese 60 per cent., and the Europeans 18 per cent. These great differences are probably not due to racial peculiarities, but rather to social customs. The wide extent as well as the mortality of epidemics among the Oriental races is largely due to their religious and social ideas. Family ties are so close and sacred that the removal of the sick is permitted only by force, and isolation is always difficult, and often impossible. Certain of their religious rites in connection with the disposal of the dead lead to frequent concealment of illness.

These factors are very serious obstacles to the sanitary control of epidemic diseases of all kinds in the East. With communication between the nations becoming closer year by year, and the

world thus becoming smaller, questions of this character become of more and more importance to cleanly and hygienic nations. The manner in which the British Government restricts these epidemics in the face of almost unsurmountable obstacles, and steadily improves the sanitary conditions of its possessions, places the civilized world under a debt of obligation. The success of the British in such work, and the recent success of the Americans in cleaning out plague spots, are among the strongest arguments for those who hold that the control of the less civilized by the more civilized nations is justifiable. Certain it is that many of these nations will not keep themselves clean of their own accord, nor cease to be a menace to those with whom they come in contact. Unless some power be invoked to compel them to keep clean, one of two results must follow: either the modern tendency to trade and commerce must be restricted, or the western nations must be content to suffer from periodical visitations of preventable filth diseases like yellow fever, cholera, and the plague.

The germ of the plague is known as the *bacillus pestis*. It is destroyed by drying in four days, and by sunlight in from three to four hours. It is killed by water below the boiling point, and by a

comparatively weak solution of carbolic acid. Rats, mice, sheep, dogs, and several other animals are susceptible to the disease, and the bacillus may be readily carried by beetles and flies. The germ exists in the soil. When introduced into unclean and filthy places it readily develops and becomes fixed. Almost without exception plague centres possess a soil polluted with decomposing animal matter. It is a fact well known that, preceding an epidemic of plague, it has also been epidemic among rats and mice. Living close to the soil, they readily become infected, and being vigorous travelers, they spread infection broadcast. This is so well known that ships entering infected ports are kept from contact with the docks, and guards to prevent the entrance of rats are placed upon the cables and stays.

The contagion of plague may be conveyed by means of infected clothing or any other article that has been used and soiled by the patient. It is doubtful whether it is spread by means of infected water, and it is also doubtful whether it can be conveyed through the air. Those in attendance upon the sick, who use proper precaution, rarely contract the disease. Prevention consists of absolute isolation, and the employment of all those measures of disinfection and hygienic care

which in civilized countries it is customary to bestow upon diseases of such nature. Vermin of all kinds should be sought for and destroyed. Particularly should rats and mice be caught and their bodies burned. Insects should be destroyed, and the room in which the patient lies should be screened.

Two forms of serum treatment are being used and carefully watched. The preventive inoculation of Haffkine is certainly encouraging in the results reported. It is designed to be given to those who are likely to contract the disease from known exposure, but have not as yet shown symptoms. The other is the antitoxin of Yersin. It is prepared in a manner similar to that of preparing the diphtheria antitoxin. Animals to which this antitoxin has been given are unaffected by an otherwise fatal dose of pest toxin. Its effect upon the human subject suffering from the disease is not marked, however, for the same reasons, probably, as are given for the slight action of the tetanus antitoxin.

TYPHUS FEVER

Typhus fever, also known as camp fever, ship fever, and jail fever, is an acute, contagious disease, characterized by very high fever and extreme depression of the vital powers. It terminates

usually in fatal cases by crisis in about two weeks. There is no other disease which numbers proportionately so many victims among nurses and physicians. Until the middle of the nineteenth century it was one of the great epidemic diseases of the world. "The history of typhus for three centuries would be the history of Europe," says Murchison. Its gradual disappearance is one of the triumphs of modern sanitation. Its last decided epidemic in Europe was during the Turco-Russian war of 1877. The last outbreak in this country was in New York in 1881–82, when 735 cases occurred.

The most important predisposing cause of typhus fever is destitution and the misery which commonly results from overcrowding and filth. The mortality is not high in young adults, but during and after middle life it is 50 per cent. or more. Endemic centres have gradually been contracted until very few remain. They are of small area and are limited to Ireland, Russia, and Italy. No other disease is so readily restricted by good sanitary and hygienic conditions, and these are the chief measures of prevention. Under the improved sanitary conditions of recent years in all civilized countries, it is doubtful if ever again typhus fever develops a widespread epidemic.

LEPROSY

Leprosy is a chronic, non-contagious, infectious disease, caused by the *bacillus lepræ*, a germ which in some respects resembles the bacillus tuberculosis. Leprosy appears in two forms—the nodular, in which thick nodules appear in the skin of the face and body, and the anesthetic, in which the sensory nerves are the first involved. The latter is characterized by a dry, flat eruption which becomes dirty white in colour. In modern times a leper "white as snow" is rarely, if ever, seen. In the later stages, the two forms are sometimes seen together, and ulcerations occur in all cases. The anesthetic variety is more commonly seen in warm climates, the nodular in cold. It is very slow in its progress, and always terminates fatally.

Leprosy is one of the oldest of known diseases. It is most prevalent in India, where it is estimated that there are a quarter of a million cases. It prevailed in Europe during the Middle Ages, but gradually declined during the sixteenth century, and is now rare except in Norway. It is probable that the rigid isolation enforced in Europe had much to do with its disappearance. In this country it occurs chiefly in three localities, Louisiana, California, and Minnesota. The numbers, how-

ever, are not large in either place. It has been known in the Gulf States since 1785, and is now slowly increasing. In California it is confined to the Chinese, but one white man being known to have contracted it. In the Northwest it is confined to the Norwegians, 170 lepers having gone there as immigrants. It is steadily decreasing, and it is believed that there were but thirty-seven cases in 1900. No native American is known to have contracted it, and there are probably less than 500 cases at present in the United States. We have, however, acquired two celebrated leper colonies, those of Hawaii and the Philippines. The disease has, therefore, become of renewed interest to our sanitarians.

Leprosy is spread only by intimate contact. It is doubtful whether it is contagious, and, if so, a special predisposition is required for its transmission. Heredity is certainly an active factor in its occurrence. The marriage of lepers should, if possible, be prevented. The English leprosy commission considers compulsory segregation as unnecessary, while the leprosy conference at Berlin in 1897 held that segregation was the best means of preventing its spread. It is a fact that where the segregation of lepers has been enforced, the number of cases in that locality has always

decreased. It would be fortunate if they could be colonized in some agricultural district, where they could live comfortably and where hospitals could be established for their care in the later stages.

DENGUE

Dengue, or breakbone fever, is a disease of tropical or subtropical countries, characterized by sudden onset, high fever, and excessive pains in the joints and muscles. It is short in its duration, and is sometimes known as three-day fever. It is a disease of low-lying regions, chiefly those along the coast, and is most common in overcrowded and unsanitary towns. It is rarely, if ever, seen in high altitudes or at great distances from the sea coast. An extensive epidemic occurred in 1828 chiefly in the Gulf States, and since that time there have been four widespread epidemics. The disease is remarkable for the rapidity of its spread and the large numbers who suffer, it being approached in this regard only by epidemic influenza. Another peculiarity is the fact that it rarely proves fatal, while the symptoms are of extreme severity.

A germ has been discovered which is claimed to be the exciting cause. The truth of this has, however, not been demonstrated. Notwithstand-

ing its rapid spread, its contagiousness has been denied by some. It has been known to occur in localities where it could not apparently have been conveyed by contagion. The theory of spontaneous generation cannot be held, but it seems possible that conditions may arise that will call germs into activity in various places at the same time. It is well known that, after the subsidence of an epidemic, the disease will remain endemic in certain localities for some time. It is a characteristic of many infectious diseases that the germs may at times lie in a comparatively inactive stage, to wake suddenly into activity with a tendency to spread and cause epidemics. There are apparently no preventive measures against dengue which can be adopted by ordinary individuals who continue their usual avocations.

HYDROPHOBIA

Rabies, or hydrophobia, is an acute, infectious disease, communicated from animals to animals, and from animals to man. In animals the disease is commonly known as rabies, in man as hydrophobia. The latter term means fear of water, and is used, not because the patient fears water in itself, but because of the dread of the spasms of the muscles of deglutition upon efforts to swallow it. The virus is contained in the saliva, and its trans-

mission is virtually an inoculation. Rabies is variable in its distribution. In Russia, England, and France it is comparatively common; in this country it is rare; in portions of Germany, where all dogs are muzzled, it does not occur. Cats are subject to rabies, as are also wolves, skunks, and jackals. The bites of the wolf and skunk are particularly virulent.

In dogs, the period of incubation is from ten to fifteen days. The first symptoms are usually sullenness, disinclination for company, and marked alterations in temperament. The dog develops a tendency to roam, and trots about for hours with his head depressed, snapping at all objects that come in his way. It is then that he is particularly dangerous to others. This stage is followed by one of excitability or of paralysis.

In man, the first symptoms are irritation about the bite, irritability of temper, sleeplessness, headache, and vague pains. This is followed by a stage of excitement which lasts from one to three days and passes into the stage of paralysis. The patient becomes quiet, and the spasms which marked the preceding stage subside, and death occurs by syncope.

Prevention consists in the destruction of all vagrant dogs, the registering and taxing of dogs,

and the muzzling of all dogs. These measures, together with the isolation or destruction of all animals who have been bitten by suspicious dogs, have repeatedly resulted in the disappearance of the disease where it has been epidemic. In Prussia, for example, such preventive measures have reduced the deaths from hydrophobia in human beings from a yearly average of 166 to 4.5. In eighteen months after the muzzling law was adopted in Vienna, rabies, which had before been prevalent, completely disappeared. A muzzling law was passed in England in 1890. For three years before that the deaths from hydrophobia had averaged 229 yearly. They at once fell to 38. The law caused annoyance to the owners of dogs, and was repealed. The deaths rose in the next two years to 672. It was again enacted, and they fell to 17, and the next year to 9, and in 1900 there were none.

The bites of animals should be thoroughly cauterized at the earliest possible moment with concentrated carbolic acid. This is more efficient in its action than is the lunar caustic or nitrate of silver commonly employed, and does not leave such unsightly scars.

The preventive inoculation of Pasteur certainly produces decided results, though it does not appear

that it is an absolute preventive. The average mortality of all classes of bites from rabid animals is about 15 per cent., while the mortality of those bitten on the head, face, and hands ranges from 60 to 80 per cent. Statistics compiled by Henri Pottevin show the striking reductions in these death rates that have been accomplished in the Pasteur Institute of Paris. In 1886, 2,671 persons who had been bitten by supposed rabid animals were treated, with a mortality of .94. This rate steadily diminished during the next seven years, and for the last five years has ranged from .22 to .50 per cent. The subject is further discussed in the chapter on antitoxins, but as there is doubt in the minds of many regarding the efficiency of Pasteur's treatment, the following quotation may be given. It is from a report made to Parliament in 1887, signed by such men as Lister, Paget, Brunton, Quain, and Roscoe: "It may be deemed certain that M. Pasteur has discovered a method of protection from rabies comparable with that which vaccination affords against infection from smallpox."

THE SUMMER DISEASES OF CHILDREN

The diarrheal diseases which occur during the summer months are among the most fruitful causes of infant mortality. While these diseases

are more prevalent, and work the greatest havoc in large cities, they are by no means confined to them. In New York City they begin to appear during the latter part of June, reach their maximum in July, and gradually subside through August and September, and almost disappear in October.

Until comparatively recent times these diseases were largely attributed to two causes—teething and hot weather. The teething theory seems to be very firmly fixed in the popular mind. Until it was eradicated from the mind of the medical profession, no progress whatever was made in the control and treatment of these disorders. To say that teething never causes digestive disturbance is to go to an extreme, but to suppose that it has more than a predisposing effect in producing these serious forms of summer disease is to make a serious error. It is difficult to understand why the teeth should produce such disastrous results at one season of the year and not another. To suppose that diarrhea is a necessary accompaniment of teething, and that a child is in fact better for it, is an error which has cost thousands of lives. Looseness of an infant's bowels, if the character of the movements continues normal, may do no harm for short periods of time; but diarrhea in which the character of the movements is changed

is never beneficial, but always detrimental. Even if the number of passages is small, they should receive attention, because serious conditions may develop at any time. Diarrhea may result from acute indigestion. In such cases a laxative to remove the fermenting matter is frequently all that is necessary for cure. It is not that form of disease, however, that is commonly known as summer diarrhea, which is an infection and the result of bacterial action. This subject has received much study from bacteriologists, both in this country and abroad. They have not discovered a particular germ as the sole cause of the various forms of summer diarrhea, but there seems to be little doubt that they may result from several different forms of germ life. This is quite in accord with the fact that the disease appears under a variety of forms and types. The discovery of a specific germ, recently claimed by Duval and Bassett, to which much sensational notice has been given by the daily papers, has not at the present writing been verified by other observers.

The question arises as to why bacteria, if they be the cause of the disease, are so active at one season and so inactive at another. It has been found that these diseases do not prevail in epidemic form until the mean daily temperature has

reached 61° F. A few days after this temperature has been attained, the summer diarrhea begins, and the city dispensaries are overrun with patients. Heated terms of extraordinary duration or severity are marked by a few more cases, due to the prostration which naturally follows such periods. Still the number of cases is not in proportion to the temperature after this mean heat of 61° has been reached. This means that the bacteria which cause these diseases begin to thrive and develop at 61°. Late June and early July are marked by a particularly large number of cases because the weak and puny infants are the first to succumb. They are only waiting for the first hot days, with the resulting milk infection, to be seized with diarrhea. Having little resisting power, they are unable to survive the attack. It is but the working of the inexorable law of the survival of the fittest. So definite is the onset of these epidemics of infectious diarrhea that frequently about the twentieth of June half a dozen cases appear at a dispensary on the first day. Thereafter until October there is never a day in which the disease is absent.

Age is an important predisposing cause. Some years ago I found, in investigating 3,000 cases, that four-fifths of them occurred during the first two

years of life, and that the greatest susceptibility was between six and eighteen months. The surroundings are an element in the causation because the disease results from contamination of the food. The constitution of the infant is also a factor, the weak and the marasmic being the first to be attacked and the first to succumb. Teething should be given a place as a predisposing cause, but it is a very minor one, and in most children it is absolutely inactive. The food and methods of feeding may be very potent causes. Of 1,943 fatal cases investigated by Doctor Holt, only 3 per cent. were exclusively breast-fed. Among the well-to-do, serious diarrheal diseases in nursing infants is extremely rare, and fatal cases are almost unknown.

All these facts lead to the belief, if other demonstrations were not at hand, that the summer diseases of children are due to bacteria which enter the system through artificial food. Three of the most important predisposing causes are overfeeding, too frequent feeding, and the habitual use of improper food. These combine to produce chronic indigestion, the most important of all the predisposing causes of diarrhea. If to these conditions are added a food which contains either poison-producing bacteria or the poison that they already have produced, we have all the elements necessary

for generating an acute infectious disease of diarrheal nature.

The exciting or immediate causes of diarrhea are two in number, and have to do with bacteria. In the first, bacteria are introduced into the system with the food. There they elaborate their toxin or ptomain, and a diarrheal disease is established. A healthy child may possibly overcome what a weak and debilitated one would not be able to. The number of bacteria, however, may be so great, and the infection so intense, that the sturdiest children are stricken. Under the second condition the bacteria develop in the food before it is taken into the body, and produce toxins. This food, taken by the child, will produce diarrhea often with greater promptness than the germs themselves acting within the body. As these facts were established one after the other, it became clear that prevention required effort in two directions, first to maintain the digestive organs in the best possible condition; second, to prevent the entrance of bacteria into the digestive tract. The treatment was considerably modified also. The bacteria having gained an entrance, it seemed like rational treatment to destroy them by antiseptics. It was found, however, that the antiseptic treatment was not very successful. It would be a

difficult task by the use of strong antiseptics to completely sterilize a rubber tube twenty feet long containing semi-fluid contents. It is utterly impossible to sterilize the intestinal canal by any known antiseptic. All the more active antiseptics in concentrated strength are poisonous to the human organization. They are, moreover, absorbed before they can reach all the bacteria. There was, therefore, another demonstration of the efficacy of prevention as compared with cure.

The first efforts at prevention are naturally directed toward destroying bacteria that might be contained in the milk. Hence was adopted the system of sterilization by heat. If milk be boiled for a sufficient length of time, every germ and spore will be killed, and if it is then protected from the air it can be kept for weeks. It was gradually found, however, that sterilizing changed the properties of milk, which is a complex and delicate compound, and easily injured. It was found that many children did not thrive well on thoroughly sterilized milk. It was gradually learned that no amount of heat would destroy bacterial poison already formed in the milk. Hence children fed upon sterilized milk sometimes fell ill as suddenly and as seriously as those fed upon raw milk. It was then demonstrated that heating to a point

considerably below the boiling temperature was sufficient to kill all the pathogenic bacteria. Hence was developed the system known as pasteurizing, by which milk is heated to 155° F. Pasteurizing causes no alteration in the taste of the milk, and avoids those chemical changes which are produced by higher temperatures. Pasteurizing has almost completely supplanted sterilizing as a means of preserving milk. An apparatus has been devised by Freeman, of New York, by which a temperature of exactly 155° can be obtained. Several other forms of apparatus accomplish the same result with more or less precision. Pasteurizing by apparatus of this type is the most certain and least objectionable method of destroying bacteria in milk. One point should be clearly understood, for there is much miscomprehension regarding it. Pasteurizing and sterilizing accomplish one result, and were never designed to accomplish more. They destroy the bacteria in the food, and nothing more. They do not render it more digestible, nor take away the necessity for modifying it.

Pasteurizing, while an improvement over sterilizing, is still but a half-way measure of prevention. It is the best that can be done in many cases, and must still be frequently employed, particularly

during warm weather. Rational prevention of the summer diseases consists in attempting to keep bacteria out of milk, rather than allowing them to enter and then destroying them. During the past five years the whole effort of those interested in this subject has been to secure the production of clean, wholesome milk. Such milk must be absolutely free from all disease-producing bacteria, with the common air bacteria reduced to a minimum. The results that have thus far been obtained have been very remarkable, and are further considered in the chapter on infant feeding. Milk is by no means the only food which causes indigestion and diarrhea. There is not a ready-made food in the market that has not its record of malnutrition, indigestion, and acute diarrhea, were the full record known.

The prevention of the summer diseases of children is thus admirably summed up by Doctor Holt: "Prevention demands (1) sending as many infants out of the city as possible; (2) the education of the laity to the importance of regularity in feeding, the dangers of overfeeding, and as to what is a proper diet for infants just weaned; (3) proper legal restrictions regarding the transportation and sale of milk; (4) the exclusion of germs or their destruction in all foods given, but especially in

milk, by pasteurizing in summer, and by scrupulous cleanliness in bottles, nipples, etc.; (5) prompt attention to all mild derangements; (6) cutting down the amount of food and increasing the amount of water during the days of excessive summer heat."

The summer diseases of children sometimes begin suddenly in the midst of perfect health as acute infections. More commonly the first symptoms are mild and of little apparent importance. The prevention of these disorders in most cases may be summed up in three words—*stop the beginnings*.

DYSENTERY

Under this term, as popularly used, are included several forms of disease resembling each other in their more important manifestations. It is essentially a disease of tropical regions, but is common in the subtropical countries, and occurs sometimes during the summer months in the temperate zone. It is one of the great epidemic diseases of the world, and one of the chief causes of death in tropical regions. Among armies it causes more deaths than result from battle. There can be little doubt that it is a transmissible, infectious disease, although a specific germ has not been demonstrated with actual certainty. The assur-

ance is growing that a bacillus discovered by Flexner, of Baltimore, while investigating tropical diseases in the Philippines, is the cause of epidemic dysentery. In certain forms of chronic dysentery, and in the type known as tropical dysentery, the ameba, an animal parasite, is almost constantly found. It is the growing belief that it is the exciting cause of these forms of the disease. The infectious agent resides within the intestinal tract, and must be eliminated from the body in the dejecta.

It is a reasonable conclusion that the disease may be transmitted by water or by food contaminated by these germs. Its dissemination is very similar to that of typhoid, and the same precautions should be observed as have been advised for that disease. By observing those precautions dysentery has been almost eradicated from the army stations of the Philippines. Only boiled water is used; the hands are frequently washed; infection of bedding, linen, and towels is guarded against. Cleanliness in its strictest sense is enforced. As a result, the report could be made with perfect truth that it is "a record never surpassed by the medical authorities of an army of white men in a tropical climate."

TETANUS

Tetanus, or lockjaw, is an acute, infectious disease characterized by spasm of the voluntary muscles. It is caused by the *bacillus tetani*, discovered by Nicolaier in 1884. It is a spore-forming germ, and very tenacious of life. It is not killed by drying, and maintains its vitality for long periods. Its habitat is the superficial layers of the soil. It is widespread, and occurs in the soil of many localities. This explains why wounds of the feet by such things as rusty nails or splinters are particularly liable to be followed by tetanus. The portal of entrance for the germs is a wound or abrasion. The first spasm usually begins about ten days after infection, and rarely later than fifteen days.

The disease appears sporadically in many places, and sometimes occurs in epidemic form. The cases alleged to have been due to vaccination, which occurred in Camden, N. J., early in 1902, were the result of infection of the vaccination or other wounds which had not been protected from contamination. Four deaths from lockjaw occurred in the early summer of 1892 in Utica, N. Y., among children who had not been recently vaccinated. The toy pistol is a well-known promoter of tetanus. The disease is particularly common among grooms and those who live and work about

stables. Several of the victims of the Camden epidemic were the children of such families. The Negro race is particularly susceptible to the disease.

A form of tetanus known as *tetanus neonatorum* is in some parts of the world a very prolific cause of death among young infants. It usually begins between the fifth and tenth days of life, and is due to infection of the unhealed navel. Ninety-five per cent. die. This type of tetanus occasionally occurs sporadically, but more commonly appears in epidemic form. In one house in Copenhagen 18 cases occurred. In the little island of St. Kilda, of the Hebrides, among 125 infants born, 84 died of tetanus. The facts becoming known in Edinburgh, some benevolent people sent a trained nurse to the island, who taught the mothers antiseptic precautions and the use of iodoform, and the disease soon disappeared. This form of tetanus is particularly common among the Negroes of the South, where it produces in some localities four per cent. of the total mortality from all causes. In some of the West Indies, half the mortality among Negro children is due to this cause. It is not of infrequent occurrence in some parts of Long Island and New Jersey.

Tetanus in all its varieties is a very serious disease, the mortality in wound cases being 80 per

cent. One of the aphorisms of Hippocrates was, "Such persons as are seized with tetanus die within four days, or if they pass these they recover." This is virtually true to-day. The prevention of tetanus consists in using the measures employed against all wound infection, the use of which is protection by means of an adequate dressing. In localities where it occurs, particular precaution should be used to properly cover the feet, and to immediately cleanse all wounds of the feet and hands. Wounds contaminated by earth or stable dirt should receive particular care. The antitoxin treatment of tetanus is considered in the chapter on antitoxins.

ERYSIPELAS

Erysipelas is an acute, contagious disease, characterized by fever, prostration, and a peculiar form of spreading inflammation of the skin. It is caused by a special form of streptococci. Like all inflammations caused by those germs, it is of a spreading or migrating character. In ordinary cases the inflammation is limited to the superficial portions of the skin; in the graver cases it involves the deeper structures. The period of incubation is from three to seven days. It is endemic in most localities, and occasionally becomes epidemic, though such epidemics are rarely exten-

sive. While the disease is contagious, it is not actively so to those in usual health. It may be conveyed by a third person, and the germs may attach themselves to bedding and clothing. The alcoholic and debilitated are particularly susceptible, and a predisposition is seen in certain families and in certain individuals. Recent surgical cases and women in the puerperal state are very susceptible to it. In such cases, however, it rarely appears as erysipelas, but as septic infection, or puerperal fever. It is not received in general hospitals, for it is one of the most potent causes of blood poisoning and wound infection. Isolation of the erysipelas patient should be strictly carried out. No person who has come in recent contact with such a case should enter the room of a confinement patient or have anything to do with her care. Neither should they have anything to do with a person having an open wound. All dressings and articles which have come in contact with an erysipelas patient should be disinfected or burned, and the sick-room should be disinfected and fumigated before it is again occupied.

PUS FORMATION AND SEPTIC INFECTIONS

There are numerous forms of suppuration and wound infection, all of which are due to bacterial action. The acute circumscribed inflammations

which result in the formation of pus are due in the majority of cases to what are commonly called the pus-forming germs. The most common of these is the *staphylococcus pyogenes aureus*, the yellow pus-producing staphylococcus. While it does not form spores, it is rather tenacious of life, and is not destroyed as readily as are some other germs. Other forms of this bacterium are the *citreus*, which produces a lemon-yellow colour, and the *albus*, which produces white colonies of germs. These various germs, particularly the first one mentioned, are the cause of numerous inflammatory conditions, notably boils, abscesses, felons, inflammations of the joints, and sometimes meningitis, peritonitis, pleurisy, and other conditions. The boil is the type of inflammation commonly caused by this germ. The inflammation tends to localize itself, and does not spread widely.

There is another germ concerned in the production of inflammation, namely, the *streptococcus pyogenes*. This germ has a tendency to cause a spreading or migratory inflammation, as in erysipelas. It is a much more dangerous germ than the first. It is the cause of some of those rapid forms of blood poisoning which result from a scratch or puncture. It gives rise to the conditions known as septic infection, or true blood

poisoning. It is these families of germs which cause so much trouble in surgery, and it is their exclusion which has resulted in so much improvement in the results of surgical operations. Pus contains some of these varieties of bacteria in living and active state. When dried they become disseminated through the air as dust, and are ready to excite inflammation in any open wound or abrasion. These pus-forming germs are so widely disseminated that any wound exposed to the air may become infected with them. The irregular sores which sometimes follow vaccination are usually the result of infection by one of this group of germs.

The serious sores and blood poisonings which sometimes follow very minute injuries, such as the scratch of a pin, are the result of infection by one of these germs. Hundreds of pin scratches cause no trouble, because no septic bacteria were present. Finally a scratch is made with a pin which has been infected with some virulent germ, like streptococcus, and dangerous inflammation rapidly follows. Dissecting wounds and post-mortem wounds are of this character. The portal of entrance for these septic germs is usually an abrasion of the skin or mucous membrane or an open wound. It does not follow, however, that every wound or abrasion will

become septic. Reference was made in the chapter on bacteriology to the power of the body to withstand pathogenic bacteria. That power is sometimes particularly marked in the case of these septic germs. The natural vital energy of the tissues of some individuals seems much greater than that of others. We frequently see individuals upon whom every scratch or minor injury causes a suppurating sore. In others, such sores are rare, and wounds heal readily. The surgeon observes this continually. Some of his patients recover rapidly, and their wounds close without difficulty, while in others the healing process is slow, and suppuration is prone to occur even when the greatest precautions are used.

From these facts methods of prevention are readily adduced. Scrupulous cleanliness and the protection of wounds and abrasions from the air are the principal measures. A full description of these methods would involve a discussion of the whole subject of surgical asepsis and antisepsis. The most important of these are thorough washing and rewashing of the hands, with subsequent disinfection, and the sterilizing of all instruments, which is best attained by boiling immediately before they are used. Both these measures should be employed even in so small an operation as the

use of a needle in opening a fester or removing a sliver. The covering of wounds by antiseptic dressings is another important measure. The sooner the dressing is applied after the wound is received, the better. While waiting for the doctor, a serious wound should be kept closely covered with cotton or a clean handkerchief wet in a carbolic solution. The effort should be made to keep the germs out of the wounds, rather than allowing them to enter and then attempting to destroy them with antiseptics. The character of the first dressing, therefore, is very important. All bandages and dressings removed from suppurating wounds, and all pus, should be at once rolled up in paper or cloth and burned as soon as possible. If this is not at once possible, they should be thoroughly soaked in a strong antiseptic solution.

Small abscesses, boils, and carbuncles are almost without exception the result of local infection. This infection may enter through a minute abrasion or gain admission through a gland or at the root of a hair. Boils are not the eliminating of so much poisonous matter which has collected in the body. That idea is one of those popular fallacies which has gained a strong foothold. The pus is all produced at the seat of the boil by the action of bacteria. Boils are pestiferous visitations which

do no good; they do not "clean the system," but tend to generate profane language and an evil temper. They sometimes occur in crops, because a person is reduced in general health or because the tissues have lost their ability to withstand the staphylococci. One boil furnishes abundant seed material for others. Great care should be exercised in dressing them and in removing all the pus from the skin. A carbolic solution should be freely used for a wide distance around the boil. Preventing the recurrence of boils does not do harm, for each one is a local infection, and is a drain upon the system. Small abscesses or pus formations of all kinds should be treated with the same car.

OTHER INFECTIOUS DISEASES

There are other diseases whose infectious character is either positively known or strongly suspected. Some of these are so rare that extended consideration is uncalled for in this place. The origin of others is still doubtful.

Bronchitis is usually caused by bacteria. Many of the acute "colds in the chest" present every characteristic of an infectious disease. The onset, fever and general *malaise*, are very suggestive of such origin. The chronic forms of bronchitis, which accompany gout and Bright's disease, are

no doubt the result of the action of their poisons upon the bronchial mucous membranes. A microbic theory is not necessary for their explanation. No one specific germ has been discovered, and probably will not be, for the condition may undoubtedly be caused by a variety of germs. Even if bronchitis be an infectious disease, exposure to cold and wet is such an important predisposing cause that it must be considered a prominent factor.

Coryza, or acute cold in the head, has also all the characteristics of an infectious disease. Numerous bacteria have been found in the secretions, and several varieties undoubtedly have power to cause the disease.

Pharyngitis, or acute sore throat, belongs to the same group as do the preceding diseases, and probably results from the same causes.

Tonsillitis is unquestionably a microbic disease. In the follicular form streptococci are most frequently found, while staphylococci are not uncommon. There is strong evidence to show that there is a close relationship between tonsillitis and rheumatism. Much evidence has been recently adduced to show that the virus of rheumatism enters the body through the tonsils. Certain it is that the tonsils are the portal of entrance of several of the general infections. The form of tonsillitis known

as *quinsy* is an infectious disease, being an abscess of the tonsil and the tissues around it, caused by the pus-producing bacteria. There is a peculiar predisposition to the disease manifested in some individuals and in some families.

Stomatitis, or inflammation of the mouth, which appears in a variety of forms, is also in most cases a microbic disease. The form commonly known as thrush is due to a funguos growth. This fungus combines with the superficial scales of the mucous membrane to form white patches upon the tongue and lips. It produces a somewhat acrid secretion which is prone to disturb the digestion. It is most common in ill-nourished infants. The so-called canker sores, which appear in the mouths of adults, are due to germs.

Ephemeral Fever is a name used to cover a variety of conditions. Certain forms of mild fevers are seen which continue one or two days and then subside. Such fevers are sometimes due to some disease which is overlooked, as tonsillitis, grippe, or even mild pneumonia. They are common in children, and are usually due to some intestinal fermentation. They continue for a few days, and upon the administration of a laxative gradually disappear. In New York a mild form of fever of rather doubtful nature is sometimes

known as "city malaria." There is also a type of fever which runs a course of ten days or more, sometimes known as bilious fever. It does not present the characteristics of typhoid fever, nor the blood reactions of that disease. It is no doubt due to some peculiar form of micro-organism of not virulent type. As our knowledge increases, these indefinite fevers diminish, and the well-read physician sees but few of them. It must be said, however, that the most painstaking examination occasionally fails to reveal adequate cause for certain attacks of fever which run a mild course and terminate within a few days without serious results.

Dyspepsia and indigestion of certain types, both gastric and intestinal, are due to bacteria or to the low forms of plant life of the class of yeasts and moulds. Such micro-organisms readily gain admission to the stomach. When the individual is in good health, and the digestive secretions are normal, they are destroyed or fail to become active. If the secretions are perverted, or if the stomach is filled with improper and indigestible food, they gain a foothold and produce the various symptoms of indigestion, of which fermentation with gas formation is the most common.

Anthrax is an acute disease due to the *bacillus*

anthracis. It was one of the first bacteria discovered, having been observed in 1855, and its causal relation to the disease having been proved in 1863. It bore an important part in the early history of bacteriology. The disease affects chiefly sheep and cattle, but it is sometimes conveyed to man by inoculation, when it appears as malignant pustule. It may run its course as a localized carbuncle that heals slowly without constitutional symptoms. In other cases the germs are taken into the lungs, and the disease is known as woolsorters' or ragpickers' disease. When generalized, it is serious, but not always fatal. Prevention consists in the killing and destruction of the bodies of all diseased animals. If buried, they should be placed very deep, for earth worms may bring the bacilli to the surface, when they may infect animals which eat the grass or grain growing there. Anthrax is the most widely spread of all the infectious diseases, but is more common in Europe and Asia than in America. A protective inoculation has been devised for use among animals. It was given to 3,000,000 sheep in Europe, and seems to have largely reduced the occurrence of the disease among them.

Glanders is another infectious disease of animals which is sometimes transmitted to man. It

occurs in horses or mules, and is characterized by nodules which form in the mucous membrane of the nose. These ulcerate and produce a profuse purulent discharge from the nostrils. While anthrax rarely affects persons not directly engaged in the care and management of animals, glanders may attack any person coming near a diseased horse. The habit of a horse of forcibly blowing irritating matter from his nostrils readily scatters the infectious matter to wide distances. If breathed by a human being, it may cause the disease, which may assume the acute or chronic type. Acute glanders is usually fatal, and is a most distressing disease. Chronic glanders may continue for long periods without proving fatal. Nodules of the same character as those found in the nostrils sometimes form under the skin of horses, and the disease is then known as *farcy*. These nodules suppurate and form open sores, which are capable of producing either glanders or farcy in the human subject. The cause of glanders is the *bacillus mallei*, which was discovered in 1882. It is a well-known germ, and has been extensively studied. Glanders is not strictly a contagious disease, but may be transmitted by the discharges. The air about a glanderous horse may be infectious, for it may contain minute

particles of pus disseminated by the snorting of the animal. Prevention consists in the killing of all diseased animals. No horse with a nasal discharge should even be taken upon the street or placed before any vehicle until the nature of the discharge is known. Preventive management of the human subject consists in strict care, and disposal of the purulent discharges.

Relapsing Fever, commonly known as famine fever, or seven-day fever, is an infectious and probably a contagious disease, marked by fever which continues for about a week, disappears for a week, and then recurs. These relapses sometimes recur several times. Relapsing fever has prevailed in Ireland and other parts of Europe. It appeared last in this country in 1869. It rarely causes death except in the feeble and aged. It is caused by the spirillum of Obermeier, which develops in the blood. The predisposing causes are overcrowding and bad hygiene. Its practical extinction is the result of the improved sanitary and hygienic conditions of modern times.

CHAPTER VI

Antitoxins

Antitoxin was the last link in the long chain of bacteriological discovery the complete forging of which required more than thirty years. The earlier portions of this work have been referred to in previous chapters. Beginning with the demonstration by Pasteur that putrefaction is the result of germ activity, it was next proved that certain diseases of animals are due to the same cause. Then followed a period of prolonged study in which the methods of isolating germs were discovered and their modes of culture were developed. Resulting from this came the ability to study their life history, methods of growth, and peculiarities. Soon after this followed the discovery of a specific germ in several infectious diseases of man. The fact was next established that it was not the germs themselves, but the poisonous products which they secrete, which cause disease. These products are known as toxins.

This was followed by study of the obscure and

intricate subject of immunity. The fact had long been known that one attack of certain contagious diseases usually renders the patient immune from subsequent attacks. As knowledge increased, the idea that artificial immunity might be conferred took possession of many observers. It was a consummation devoutly to be sought, and most painstaking research was devoted to this end. It was then discovered that certain elements antagonistic to the toxin were developed in the body, and these were known as antitoxins. It was found that antitoxin was formed after the introduction into the body of the toxin from which the germs had been completely removed by filtration. This was an important step, for it began to be evident that antitoxin might be produced without the introduction into the body of germs. The germs, once introduced, will multiply, and it is difficult to control their action. A chemical poison can be regulated as to dose, and its action can be controlled. It was then discovered that the injection of a certain amount of toxin into an animal would result in the production of a certain definite amount of antitoxin. The administration of this small amount of toxin would produce slight symptoms only. It was then found that a larger dose could be injected without harm, for a portion

would be neutralized by the antitoxin already existing in the blood. This was an important discovery, for it was learned that animals could receive repeated injections of toxin of constantly increasing size, because the amount of antitoxin was steadily increasing. After a time the blood of the animal would contain a much larger amount of the antitoxin than it would even after an attack of the disease. It was then surmised that the blood of a large animal might be so charged with antitoxin that a portion of it might be injected into the body of a smaller animal and thus furnish to it sufficient antitoxin to render it immune to the poison of the disease which it would ordinarily receive from exposure. This was proved to be the fact, and the only remaining step was to inject the serum of a highly immunized animal into a human subject. This was done with success, as we all know. There has been nothing more precise and definite in scientific discovery than this gradually working up to the antitoxin treatment of diphtheria. There was almost a mathematical demonstration of its efficacy before the first dose had been given to a human subject.

Diphtheria has been the disease in which the most positive results have been obtained from antitoxin treatment. For various reasons it has

been most available for study, and the problems involved have been easier than those presented by other diseases. The exact rationale of the formation of antitoxin after the introduction into the body of toxin is still obscure. Opinions still differ, but there is no difference of opinion regarding the fact that it appears after the injection of the toxin without the injection of the germs. The antitoxin resides in the serum of the blood. It has long been known that this serum has properties antagonistic to germs, and it is possible that the immunity shown by certain individuals to certain diseases is the result of some antitoxin element in the blood serum.

The antitoxin of diphtheria is obtained from the blood serum of the horse. This animal is selected because it is insusceptible to most human diseases and can furnish a large amount of blood serum. Absolutely healthy horses are selected. They are placed under strictly hygienic conditions and are kept under the daily inspection of an expert veterinary surgeon. A definite quantity of the toxin is injected under the skin. This is followed by slight local and general symptoms. After a few days another dose, larger than the first, is injected, and thereafter doses of constantly increasing size are injected at regular intervals. Anti-

toxin gradually forms in the blood, the amount increasing after each injection. Finally, after several weeks, the antitoxin-forming power reaches its limit, which differs in different animals. Blood is then drawn under the strictest antiseptic precautions; the serum is separated and put into small vials or hermetically sealed tubes. Enough is placed in each to furnish one dose of antitoxin. Several sizes are made, so that any dose may be obtained.

The method of measuring the dose is somewhat peculiar. As the amount of antitoxin in each sample of serum varies, the amount of serum given would not furnish a true guide. The standard of measurement is known as an antitoxin unit. A sample of each batch of serum is administered to a guinea pig, to which has also been given a certain dose of toxin. These animals are very evenly susceptible to the toxin, a certain definite amount being necessary to kill an animal of given weight. An antitoxin unit is the amount of antitoxin required to neutralize one hundred fatal doses of diphtheria toxin of standard strength. The amount of antitoxin now commonly given to protect children in ordinary cases is from 2,000 to 3,000 units. A single injection in most cases is sufficient, but it may be necessary to repeat it

once or several times. It is always given by hypodermic injection.

When the use of antitoxin was begun in this country, early in 1895, many fears were expressed regarding it, and it underwent an ordeal of fierce criticism. That opposition has almost completely disappeared. It may be truthfully said that less objection is made to its use than to vaccination or to any other plan of treatment in common vogue. A few undesirable symptoms sometimes arise. In rare cases an eruption similar to hives occurs in the second week after the injection. This is annoying rather than serious. It seems to be largely a personal matter. Among five children in the same family receiving antitoxin from the same bottle at the same time, I have seen an eruption in two and none in three. Other undesirable results following the use of antitoxin, which is obtained from three or four leading American makers, are so slight and so rare that they need cause no apprehension.

The importance of the early administration of diphtheria antitoxin cannot be overstated. A single example will illustrate this. Among 4,120 cases reported by the American Pediatric Society, the death rate of those receiving the injection on the various days of the disease was as follows:

Injection given	1st day	mortality	4.7	per cent.
" "	2d "	"	7.4	"
" "	3d "	"	8.8	"
" "	4th "	"	20.7	"
" "	5th "	"	35.3	"

Such figures teach their own lesson. The antitoxin should be given in every suspicious case without waiting for the development of serious symptoms, or even until a bacterial culture can be examined. The earlier the dose can be given the more certain the result will be. In a disease as serious as diphtheria we must expect that there will be a few malignant cases, or cases occurring in feeble children or those reduced by illness, who will succumb in spite of any treatment. Infants under one year, and particularly under six months, have very little resisting power, and many of the cases reported above were at that age. Some recent investigations show that in 183,256 cases of diphtheria occurring in 150 cities before antitoxin, the mortality was 38.4 per cent. Since antitoxin was introduced, among 132,548 cases there was a mortality of 14.6 per cent. These cases were not all treated, however, with antitoxin. Among the cases so treated the mortality was 9.8 per cent. In the Boston City Hospital, where the treatment has always been carried out with particular knowledge and care, prior to 1895 the mor-

tality was 46 per cent. Since that time, among more than 7,000 cases treated with antitoxin, the mortality has been 12 per cent. It should be understood that the death rate in such a hospital is always high, for many cases are moribund and die a few hours after admission, and there are also many ill-nourished children from the poorest quarters.

The effect of antitoxin is sometimes disappointing to parents who expect a striking and immediate result. It rarely, if ever, produces a theatrical effect. Improvement is not commonly seen for several hours after injection. Twelve hours or more usually pass before a change is apparent. Recovery takes place by somewhat slow degrees, one symptom after another becoming less urgent and gradually disappearing. The fever subsides, appetite returns, the child seems brighter and less prostrated, the membrane gradually disappears from the throat, and the soreness subsides. So gradual is the change during the course of one or two days, or perhaps longer, that those who have not had experience with the unmodified disease in its dreadful course, often prolonged through days, sometimes fail to appreciate what the treatment has accomplished.

One of the most important uses of diphtheria

antitoxin is for immunizing those who have been exposed to the disease. For this purpose a small dose is given, and there is no question whatever as to its efficacy in preventing the occurrence of diphtheria. If given soon after the exposure, in rare cases a membrane appears in the throat, but the disease, even without more antitoxin, is usually mild. Unfortunately, it does not confer protection for a long period of time. An attack of diphtheria itself does not do this, as does measles and scarlet fever, and we could not reasonably expect more of antitoxin. Among 1,808 patients who received immunizing doses of antitoxin upon entering the Children's Hospital of Boston, it was found that the immunity continued from ten to twenty days, and sometimes longer. The physicians of that hospital concluded from their experience that certain immunity could be conferred if the injection was given twenty-four hours before exposure, no matter how thorough the exposure. This period of immunity, averaging from two to three weeks, is short, but it is ample to carry the child past the danger period after the exposure. The period of incubation, it should be remembered, is usually about two days, and rarely more than six. This short period of immunity conferred by antitoxin explains the reason for

not giving it to every young child, as vaccination is done.

Croup.—Diphtheria of the larynx, or membranous croup, is one of the most fatal diseases of childhood. The mortality in untreated cases is more than 90 per cent. The disease involves the narrowest portion of the respiratory tract, and causes death chiefly by mechanical obstruction. Until about twenty years ago, treatment consisted in tracheotomy, in which an incision was made into the throat from the outside, through which a tube was inserted. This reduced the mortality to about 70 per cent. While this method removed the effects of obstructions, the child was still affected by a malignant form of diphtheria. A great improvement over tracheotomy was effected by the operation of intubation, devised by Doctor O'Dwyer, of New York. By this operation a small tube is inserted into the larynx through the mouth. It is somewhat more effective than tracheotomy in saving life in the cases operated on. It has actually resulted in saving many more lives, because there is less objection to its performance on the part of parents. It is, therefore, done earlier and in a greater number of cases. No knife is used, for there is no incision in the throat; no anesthetic is required; the tube can be quickly

and easily removed; and no wound is left behind. This proved to be one of the most beneficial devices of modern medicine. It is expected to accomplish one thing, and one only, the relief of obstruction at the narrowest point in the throat. Unfortunately, the diphtheritic membrane has a strong tendency to extend downward through the bronchial tubes into the lungs. Here it induces pneumonia, which is the cause of death in most fatal cases of croup after intubation. Various modes of treatment were tried with the hope of preventing this extension and saving the patients from the poisonous effects of diphtheria. Several of these methods were followed by some benefit, but the death rate still continued between 60 and 70 per cent.

Antitoxin has to a large extent accomplished these much desired effects, and the combination of antitoxin and intubation has accomplished one of the most brilliant results of modern medicine. They are in a most striking way complements of each other. Each alone is effective in reducing the mortality of one of the most fatal diseases. Hand in hand they have reduced that mortality to a point which would have seemed incredible ten years ago. Antitoxin to a large degree controls the diphtheritic process, and by preventing its

extension downward into the lungs, holds it in check in the larynx. Here the intubation tube can reach it and overcome the mechanical obstruction until the membrane disappears.

The effect of antitoxin is more marked in croup than in any other form of diphtheria. Among the best results reported before its adoption were those of a certain group of 8,383 cases, with a mortality of 69.5 per cent. The American Pediatric Society, in an investigation upon 1,704 cases treated by antitoxin, found a mortality of 21.12 per cent. The most remarkable feature, however, shown by these cases, was the large number which did not require operation. The investigation proved that, with antitoxin, six cases of croup in ten did not require an operation, and eight in ten recovered. Doctor O'Dwyer's own experience was very striking. Before his lamented death he was the greatest authority upon this class of disease. He had performed 470 operations with a death rate ranging from 70 to 73 in each hundred, the average being 72.44. And then something happened which stopped forever these terrible rates of mortality, and that something was antitoxin. After its introduction, Doctor O'Dwyer did 59 operations with a mortality of 23.7 per cent. This means that the lives of 229 children would have been

saved in the practice of this one man had antitoxin come ten years earlier.

The rule should be in croup, as in other forms of diphtheria, to administer the antitoxin at the first definite symptom, and not waste time and the strength of the patient with depressing and futile treatment, which can accomplish little or no good. These investigations of the American Pediatric Society were completed more than four years ago. Since that time antitoxin has been given more freely and more promptly, and recent results have been even better than those reported. "Few of the most useful methods of treatment have been subjected to the same fierce criticism as was the antitoxin of diphtheria, and still fewer have borne the ordeal as triumphantly," says the *British Medical Journal*.

OTHER ANTITOXINS

Numerous other antitoxins have been produced, but no results have been obtained as satisfactory as those resulting from the use of diphtheria antitoxin. A reference to the table showing the results of diphtheria antitoxin when given early will afford one explanation for the failure to obtain good results with other serums. It will be seen by the table that effective results are obtained only when the antitoxin is given early. In diph-

theria, we have conditions differing from those found in almost any other disease. The germs do not enter the body, but develop in the diphtheritic membrane, where they elaborate their poison, which is then absorbed into the circulation. The membrane in the first day or two, therefore, is a danger signal which gives warning of the illness which is to follow, when the germs have multiplied and developed their poison. In other diseases, as pneumonia, we have no means of knowing that the germs are present until the patient is suddenly taken ill and the disease is under full headway. Administering an antitoxin then is like administering it in diphtheria on the fourth or fifth day. While some benefit is secured, and the death rate somewhat diminished, the marked results of early administration are not obtained. This is one reason why we cannot expect the same results in other diseases that we obtain in diphtheria. The tetanus antitoxin is a clear example of this difficulty. A high degree of immunity against tetanus can be conferred on animals, which then yield a very potent serum. When the disease is under headway in animals, however, this same serum is ineffective to cure. This is due to the damage which the toxin has already produced

upon the nerve cells by the time the symptoms have appeared.

In several diseases attempts to produce an antitoxin have so far failed. Those diseases caused by strictly parasitic germs offer peculiar difficulties, for it is impossible to cultivate them outside the body with sufficient vigour to produce an active toxin. This renders it impossible to secure sufficient toxin to use upon animals to produce an antitoxin. A very serious obstacle in other diseases is the fact that no *soluble* toxin can be obtained with which to generate the antitoxin. The serum for one disease has no effect upon other diseases. Even the diphtheria serum, effective as it is against the toxins produced by the diphtheria bacilli, has little effect in neutralizing the toxins produced by the pseudo-diphtheria germs. It is clearly demonstrated that each germ must have an antitoxin of its own.

Antistreptococcic Serum.—This serum has been employed for several years in the treatment of septic infections. It has been fairly successful in limited cases, but the dose is large and not entirely free from deleterious effects. It cannot be called a marked success. It has been used chiefly in scarlet fever, erysipelas, and certain forms of pus infection. A special form of serum

for use in scarlet fever has very recently been obtained by Moser, of Vienna, which promises to give better results than any yet used in that disease.

Pneumonia Antitoxin.—This serum has quite satisfactorily fulfilled the requirements of laboratory administration. It will preserve animals from many times a fatal dose of the virulent culture of the pneumonia germ. The actual application in cases of pneumonia has failed to show that it is of much utility, from causes, perhaps, already suggested. A difficulty of producing this serum had been the fact that the pneumonia germ does not produce in an artificial culture any strong soluble toxin.

Typhoid Antitoxin.—More than one form of serum has been produced as a typhoid antitoxin. One of these was used as a preventive agent quite extensively at Ladysmith during the South African war. The results were apparently quite satisfactory, but not brilliant. It has also been used with apparently moderate results in India as a preventive measure.

Plague Antitoxin and Serum.—The preventive plague vaccine of Haffkine continues to be employed with increasing confidence as a protective agent against bubonic plague. As the immunity it conveys is short, it is necessary that it be repeated

about once in twenty days. The curative serum of Yersin, differing from the vaccine, has reduced the death rate somewhat.

Hydrophobia Inoculation.—Statistics prove the importance of the Pasteur treatment of hydrophobia as a preventive measure in man. Horsley, of England, after extensive investigation, found that 15 per cent. of those bitten by rabid dogs contracted the disease, and 40 per cent. of those bitten by wolves. The mortality of those affected ranges from 60 to 80 per cent. At the lowest rate of mortality, we should expect 9 per cent. of deaths of those bitten by dogs. The cases treated in Paris for eight years numbered 13,817, and the mortality was but .5 per cent. Allowing for all possible errors, this certainly seems to show undoubted effects of the treatment. Preventive inoculation can be performed successfully in dogs who have been injected in the laboratory with active virus. It is not, therefore, unreasonable to suppose that the same inoculation will be effective in man if given early. This subject is further considered in the section on hydrophobia.

Tetanus Antitoxin.—The poison of tetanus is a tox-albumin of extraordinary power. It is probably the most virulent poison known. An immunizing serum has been obtained of decided power as

shown by the fact that it will neutralize the effect of large doses of the toxin if given to animals, provided it be administered before the toxin has had opportunity to injure the nerve centres. If such injury has taken place, it is not to be expected that the cells can be restored. We see in tetanus and pneumonia two of the difficulties in producing practically effective antitoxins. In the one case an effective antitoxin has been produced, but no indication usually arises for its administration until the poison of the disease has caused irreparable physical injury. In the second class, owing to peculiarities in the growth of the germ, an adequate antidote has not been obtained.

Tuberculosis Antitoxin.—Several antitoxins for tuberculosis have been obtained by different workers, and have all received the most careful attention. Most of them have been tested with particular care at Saranac. While one or two have shown some slight degree of power, they have not developed any marked curative influence over the course of the disease. At the present writing there is no antitoxin for tuberculosis worthy of reliance. Behring, whose name is so intimately associated with diphtheria antitoxin, has recently expressed the belief that a serum for the treatment of tuberculosis was nearing perfection.

CHAPTER VII

VACCINATION

VACCINATION is the most potent measure of prevention which man has yet discovered in his long warfare with disease. That doubt as to its efficiency exists to-day is due largely to ignorance of facts. There is a peculiar tendency in certain minds to question even the simplest propositions. It must be said that this country seems to afford extraordinary facilities for the development of that particular form of mental pervert which perpetually takes the opposite side and objects to the established order of things. It is to this class that those belong who may be called professional anti-vaccinationists. There are, however, people in every community who, through lack of knowledge, believe themselves to be opposed to vaccination. They are intelligent and conscientious, and form a class apart from the professional agitators, to whom reference has just been made. Almost without exception the articles which appear against vaccination are written by members of

the first-mentioned class. They are mostly written in a petulant tone, and are utterly lacking in logic. They are extreme in statement, and, as a rule, are positively untruthful. The extreme views held by the professional anti-vaccination agitators are shown by the following statement of principles taken from an editorial article in the September, 1902, issue of the organ of the American Anti-vaccination Society: "I advocate: no vaccination, no medical laws, no medical health boards."

The number of those who conscientiously oppose vaccination is very small. The head of the New York Health Department, although a strong believer in vaccination, last winter opposed a compulsory vaccination bill pending before the Legislature. His ground was, that it would arouse opposition and was unnecessary, as the inspectors of the department found virtually no one who refused to be vaccinated.

It is entirely reasonable to insist that in a procedure like vaccination certain requirements should be fulfilled. A vaccination sore should pass through certain well-defined stages. If it does not do so, it is not an adequate vaccination, and cannot be expected to confer full protection. The following is the typical course of a vaccination. On the third or fourth day after vaccination, a faint

redness appears at the point of inoculation. This redness gradually increases, and a little reddish papule is formed. The papule gradually changes to a vesicle, which at first contains a thin, transparent fluid. By the eighth day the fluid has become yellowish in colour, and in the centre a little depression may be seen. About this time a circle of inflammation appears about the vesicle, which is called the areola. By the tenth day the inflamed skin is tense and painful, and streaks of redness often extend out for a considerable distance. By the twelfth day the vesicle begins to dry, and by the fifteenth day a crust has formed. This crust is of mahogany colour, rough, but thinner in the centre than toward the edges. It rarely falls before the end of the third week. The scar is at first red, but soon fades, and has a pitted or streaked appearance.

About the tenth day, and often earlier, general symptoms frequently appear. There may be a slight fever with chilly sensations and malaise, but these symptoms are rarely severe or prolonged. By recent methods of vaccination the general symptoms are often very mild and the local sore is small. If it pursues the course described, even if the soreness is slight, it is adequate. On the other hand, severe soreness is not itself an evidence

of satisfactory vaccination. If there is a radical departure, particularly in the earlier stages, from the course outlined, the vaccination is not to be relied on.

As to the dangers of vaccination, they are few. When the operation is properly done with properly selected lymph, and the sore is adequately protected, the dangers are virtually none. The serious results which sometimes follow vaccination usually come from infection of the sore. The lymph, which is prepared to-day by certain well-known and reputable makers, does not contain pathogenic bacteria. The charges made against vaccination, when investigated, are almost invariably found to be without foundation. The physician often hears of the appearance of a disease attributed to vaccination performed weeks, months, or even years before. Illness is so common among young children that coincidence is not an uncommon factor. Many inherited weaknesses are attributed to vaccination which could by no possibility result from such a cause. It is comforting to the parents to have some such explanation for defects, rather than to attribute them to inheritance or improper management, and vaccination is the catch-all for such purposes. A case of bowlegs, the result of rickets caused by feeding with condensed milk,

was recently attributed in my hearing to vaccination, and nothing would shake the faith of the mother in her theory. The bowlegs did not appear until after the vaccination; and it had been done on the leg.

Most of the arguments made to-day against vaccination date back to the time of Birch and Rogers, in 1805, and are based in considerable measure upon experience at a time when arm-to-arm vaccination was practised. By that method blood diseases were undoubtedly occasionally transmitted. The bovine species, from which all vaccine lymph is now obtained, is not susceptible to syphilis, and that disease is never transmitted by vaccination. It is a peculiar disease in its manifestations. Infants affected with it are very frequently born apparently healthy, and the first signs usually show themselves during the third and fourth weeks. Many cautious physicians, therefore, refuse to vaccinate a child before the end of the sixth week. The disease has many times been charged to vaccination, and physicians have received undeserved censure, when it was in fact congenital.

Tuberculosis is not transmissible by modern vaccine lymph. It is extremely doubtful whether tubercle bacilli ever appear in the lymph even in

animals suffering from the disease. To guard against any such chance, however, the leading makers examine post-mortem every calf from which lymph has been taken. If any evidence is found of tuberculosis or other disease, the lymph from that animal is rejected. Moreover, bacterial examinations are made of all samples of lymph. A few great firms make much of the lymph now used in this country, and could not afford to have accidents happen from the use of their products.

Serious sores are caused by extraneous germs. Their introduction may result from lack of care in performing the operation, but more often from improper care or injury after it is performed. Vaccination should be done with surgical cleanliness. The sore may become infected like any other abrasion of the skin, and requires adequate care. In this way purulent infection and erysipelas may occur. Infection is more common when vaccination is done on the leg, where it is more apt to be infected with dust. Little girls who are vaccinated on the leg, and are then allowed to run about with the sore unprotected, are particularly liable to develop complications. Such complications may be prevented by a protective dressing. A heavy surgical dressing is not advis-

able, as it sweats and softens the scab. Shields are more apt to cause trouble than to prevent it. This is particularly true of those that are covered or have hard edges. Talcum powder should be freely used, particularly if the sore be moist. A light gauze bandage, changed frequently, is the best dressing when it does not stick in the sore. When there is considerable soreness, or the dressing sticks, a light wire shield or a perforated felt shield of large size is admissible, and often gives much comfort. A few turns of light gauze bandage should be placed over this. Tearing off the scab, or any other serious injury to the sore, should be reported at once to the physician. Should the sore have become infected and purulent, he should also be consulted.

The very effectiveness of vaccination has rendered people ignorant of its value. So little smallpox is seen at the present day that they have become apathetic regarding it, and in many localities vaccination is much less thoroughly carried out than it was a hundred years ago. With a full knowledge of the seriousness of the disease, and with the clear evidence of the efficacy of vaccination, the operation was then extensively and thoroughly performed, and the disease in many localities was completely extirpated. In Denmark,

for example, the practice was so effectively enforced that in 1826 there had not been a case of smallpox for eleven years. It was then reintroduced by a traveler from Hamburg. In Sweden the mortality dropped from an average of 2,045 deaths in a year to 480. In Vienna, in 1800, the deaths from smallpox had averaged 835 a year. After the enthusiastic introduction of vaccination in 1801, the deaths fell during the four following years to 164, 61, 27, and 2 respectively.

As to what may be expected from vaccination, we may quote the words of Jenner, whose claims, though always positive, were judicious, and by no means extravagant. His own words were: "Duly and efficiently performed, it will protect the constitution from subsequent attacks of smallpox as much as that disease itself will. I never expected that it would do more, and it will not, I believe, do less." Shortly before his death he said, "My opinion of vaccination is precisely what it was when I first promulgated the discovery."

It will thus be seen that no exaggerated claims were made by Jenner, nor have there been by any judicious physician. Vaccination is not expected to protect from smallpox more than will the disease itself. The infectious diseases are occasion-

ally repeated in the same individual. Second attacks of smallpox are very uncommon. Marson saw forty-seven second attacks among 5,982 smallpox patients. Haeser states that in Verona twenty-four cases of second attack were observed within ten years. This means that the period of immunity is not always lifelong. A limited period of immunity is common to several of the infectious diseases. In diphtheria, for instance, immunity continues for but a few weeks. In smallpox, while in some cases it is lifelong, in others it is limited. It is to be expected, therefore, that the immunity conferred by vaccination may have its limits, and it is not a valid argument against the procedure that it must be performed more than once.

Jenner studied the subject with which his name is so intimately associated with the minutest care, and was a master of it in all its details. Upon one essential point only was he in error. He believed that vaccination, thoroughly and properly performed, would insure immunity for life. This was not unnatural, for he saw absolute immunity conferred by the operation, and it required many years of observation to demonstrate that such immunity might not be perpetuated during the life of the individual.

The first attempt to check the ravages of smallpox was by inoculation. The idea was derived from the Levant, where the system has long been practised. It consisted in inoculating the system with virus from a smallpox patient. It is the fact that the disease produced by such inoculation is usually less serious than that acquired by ordinary exposure, and the death rate is much lower. Still it is considerable. It seems strange at first thought, therefore, that the operation did not result in good. The patient was as dangerous to others as was the one with the regular disease, and, hence, each case formed a new focus of infection. Many cases ran such a mild course that the patients could not be properly restrained, and proved a public danger. As a result of these causes, therefore, the system of inoculation did not diminish the frequency of the disease in England. It must be said, however, that the attempt to limit it by this means was entirely proper and legitimate.

The first vaccination of a human subject was performed by Edward Jenner on May 14, 1796. He had long been studying the question, which had been called to his attention by the fact that the milkmaids of certain districts of England rarely contracted smallpox. It was a matter of popular, though local, observation that the immune

persons who had not had smallpox had been inoculated by cowpox. Little James Phipps was the first subject. His vaccination ran a typical course, and six weeks after a second vaccination, as Jenner had confidently predicted, produced not the slightest effect. After other unsuccessful trials, the boy was taken through a smallpox hospital without the slightest harm, as we of the present day can readily believe. Two years later Jenner published his observations in a little book of seventy-five pages entitled, "An Inquiry into the Cause and Effects of the Variolæ Vaccinæ, a Disease Discovered in Some of the Western Counties of England, Particularly Gloucestershire, and Known by the Name of Cowpox." The importance of this little volume and its epoch-making character is proof that the reputation of an author or scientist rests not upon how *much* but how *good* his work is.

From the publication of this little book the adoption of vaccination was very rapid, and it soon spread over the civilized world. Its enemies were, to be sure, many and venomous. The system was opposed by many physicians, and was denounced from many pulpits with great bitterness as an attempt to beastialize the race. It, however, made headway in spite of all opposition. The first vaccination in America was per-

formed in Boston, on July 8, 1800, by Doctor Benjamin Waterhouse, Professor of Practice of Physic at Harvard. He vaccinated seven of his own children, six of the vaccinations being successful. Shortly afterward three of them were sent to the smallpox hospital and one was inoculated with smallpox. None of these, it is needless to say, contracted the disease. The first vaccination in New York was performed by Doctor Seaman, in May, 1801. The operation was introduced into the southern States through the personal efforts of Thomas Jefferson, then President, who fully understood the ravages of the disease among the coloured population.

Jenner vaccinated all who came to him. There were sometimes 300 waiting at his door. He would have become impoverished were it not for liberal grants from Parliament. He sent out lymph to the ends of the world, and carried on a wide correspondence. He became, in his own words, "Vaccine Clerk to the World." He died on January 26, 1823, and was buried in the village church, an offer of a grave in Westminster having been declined by his family. He was modest, and fond of a quiet life and simple pleasures; a man of great practical sagacity as well as originality of mind. The faith in vaccination, and the honour

in which Jenner was held by his own generation, who understood smallpox so well, is shown by the fact that Parliament twice voted him grants of money amounting to £30,000, while Napoleon, the bitter foe of the English, liberated prisoners at his request.

To comprehend what vaccination has done for the world, we must understand what smallpox was when Jenner first announced his great discovery. Its extreme contagiousness, its excessive rate of mortality, its loathsome character, and the maiming and disfigurement it left behind, combined to make it the most serious scourge from which the race has suffered. It has been justly described as the "Attila of diseases, the very scourge of God, overrunning countries and destroying whole populations." When Jenner performed his first vaccination, in 1796, smallpox was causing one-tenth of all the deaths of the human race. Bernouilli, the mathematician, estimated that more than 60,000,000 of the inhabitants of Europe died from smallpox during the eighteenth century, being an average of 600,000 a year. Others place the number even higher. Specific proof of its fatality is shown by Cowan's vital statistics of Glasgow. He states that between 1783 and 1792, 36 per cent. of all the deaths under ten years were due to smallpox, and

between 1793 and 1802, 32 per cent. were due to that cause. These are no uncommon figures, for it was asserted by others that one-third of all deaths under ten years were due to smallpox. It was estimated by Condamine that this foul disease destroyed or disfigured the fourth part of mankind.

When smallpox was introduced into Mexico by the Spaniards in 1520, 3,500,000 died within a few years. In 1737, 70 per cent. of the people of Greenland died of smallpox. In 1707, in Iceland, 18,000 in a population of 50,000 died in a single year. It is believed that 6,000,000 North American Indians fell victims to its ravages. It has done more to exterminate the aborigines of this continent than any other cause. In 1838 the destruction of life was enormous, whole tribes being exterminated. Among half-civilized nations the appearance of smallpox often caused the abandonment of whole towns, the sick being left to their fate. The capital of Tibet, for example, was at one time left without inhabitants for several years after a visitation of the disease. In the present century Ceara, in Brazil, was visited by smallpox, and in a population of 70,000 there were 40,000 victims.

Among civilized nations the ravages were

almost equally great. It attacked every class and order from the peasant to the king. It wrought wholesale havoc among royal families, notably those of England and Austria. When Louis XV. of France died of smallpox, the corpse was deserted by every one except a few priests, who were detailed and forced to perform the last rites. The disease had a marked influence not only upon the history of nations, but in modifying the character and habits of life of the people.

Macaulay refers frequently to smallpox in his history of England, and in the fifth volume thus speaks of it: "That disease over which science has achieved a succession of glorious and beneficent victories was then (in the last years of the seventeenth century) the most terrible of all the ministers of death. The havoc of the plague has been more rapid, but the plague had visited our shores only once or twice within living memory. The smallpox was always present, filling the churchyard with corpses, tormenting with constant fears all those whom it had not yet stricken, leaving on those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to her lover."

"If a modern traveler," says Doctor Hyde, "could be transported to London in the early part of the present century, no peculiarities of architecture, dress or behaviour would be so conspicuous as the enormous number of pockmarked faces he would encounter at every turn." The comparative frequency of pockmarked faces is shown by the following description of a criminal issued by the London police authorities in 1688: "Thomas Baily, a short, burly man, fair and fresh coloured, without pock-holes, flat-nosed, under forty years old, commonly wears a fair perriwig, and useth a blue as well as a red coat."

Writing in 1747, Doctor Black said: "Very few of the human species escape the smallpox, especially in populous cities and towns wherein there is always lasting variolous fuel. . . . A mere handful of the native progeny of the metropolis can be supposed to have escaped an infection with which they are constantly enveloped." One hundred years ago smallpox was the most widespread disease which afflicted the human race. To-day many physicians of large experience have never seen a case. Communities of thousands of inhabitants pass months and even years without its occurrence. No sane person of adult years can

read history without believing that some marvelous power has been at work to produce this change. What else can it have been but vaccination?

It will surprise many to know that in former times smallpox was essentially a disease of childhood, more than 80 per cent. of all cases occurring in children under five years. As vaccination is done chiefly in infancy and childhood, it is a strong proof of its efficacy that it has been transferred from childhood to adult life, when immunity has been exhausted.

Let us now consider the history of smallpox since Jenner's time and compare it with previous conditions. In England, it has been estimated that in 1660 the average annual number of deaths per million from smallpox was 4,170. Doctor Farr estimated the rate per million at 4,260 for the thirty years from 1728 to 1757. Official registration of the causes of death began in 1838. From that year to 1854, a period of optional vaccination, the average rate per million was 430. From 1854 to 1894, a period of enjoined vaccination, the rate for the whole period was 140. From 1872 to 1894 the laws were more rigid, and the rate was 86. Excluding the epidemic of 1872, it was but 53. In the fourteen years preceding 1872, the average death rate from small-

pox in the British army per 100,000 strength was 11.1; for twenty-two years after that date, 3.7. This was rendered even higher by the loss in 1899 of twenty-three men in India. In 1895, in a population of more than 4,000,000, there were 55 deaths from smallpox in London. With less than one-fourth that population, Sir J. Simon states that during the eighteenth century the annual death rate of smallpox in London ranged from 3,000 to 5,000.

Sweden furnishes some particularly valuable facts, for excellent records have been kept since 1774. Between 1774 and 1901, the average smallpox mortality per million living was 2,045. During fifteen years (1802 to 1816) of optional vaccination the average mortality was 408, and for seventy-seven years of compulsory vaccination it averaged 155. During the ten years from 1884 to 1893 (the latest record I can obtain), under still more rigid laws, there was no year in which the rate per million was above 5; it was in one year as low as .2. In the twenty-eight years before 1801 the rate was more than 1,000 in eighteen different years, reaching in 1779 the enormous figure of 7,196. Since 1801 it has been below 100 in forty-six different years, and below 10 in fifteen different years.

Attempt has been made by anti-vaccinationists to minimize the value of these remarkable figures by the theory that there was a natural decline in smallpox before vaccination had been adopted. The facts are, however, that vaccination was taken up in Sweden with the utmost enthusiasm. It is known that in 1802, eighty physicians had lymph in their possession. In 1804, royal orders required vaccination by means of the pastors of churches, while in the following year the Royal College alone reported 25,000 vaccinations. It certainly requires great credulity to believe that the rapid fall in the mortality rate from 2,045 to 480 was due to a change in the character of the disease.

Prussia also affords some convincing evidence of the efficacy of vaccination. The Prussian army was the first place where vaccination was required on a large scale. It was begun in 1834, and during the next fourteen years there were but 77 cases of smallpox and varioloid, and not one death. In 1843 an epidemic of smallpox occurred in Prussia, but in the army there were but 12 cases. During the Franco-German War the German troops, about 1,000,000 in number, were well vaccinated, and but 457 deaths occurred from smallpox. In the imperfectly vaccinated French army, on the other hand,

though smaller in size, there were 23,400 deaths from that disease. It should be understood that the troops from the other States making up the German army of that time were not so thoroughly vaccinated as were those of Prussia, but all were vastly better vaccinated than were the French.

Since 1874 a much more rigid vaccination law has been in force in Germany. Vaccination of all infants is made compulsory, with revaccination at school age. The mean death rate from smallpox per million before this law was 409; since the law was passed it has been 15; during the last ten years, 7. In the army, in which the vaccination law is most strictly enforced, there has been but *one* death from smallpox since 1874. The general rate has never risen materially since that year. The cases that have occurred have been largely upon the frontier and among foreigners.

These figures from Prussia have given the anti-vaccinationists much perturbation of spirit They have been able to get around them only by actual untruth, in asserting that the law of 1835 was a compulsory vaccination law. That law urgently recommended vaccination, but did not make it compulsory. Such a law was passed only in 1874. The anti-vaccinationists have tried to explain the diminished death rate here, as in Sweden,

upon the ground of improved sanitation. The argument is absurd. There was no sudden improvement in the sanitary conditions in either country, and Prussia and Sweden are not more sanitary than other countries where there has been no such radical change either in the occurrence or mortality of smallpox.

In Austria, vaccination is not compulsory, and there we find some striking facts of different character. During the years in which the death-rate from smallpox in Prussia was 7, in Austria it was 458. In Belgium, another country in which vaccination is not compulsory, the death rate per million from 1875 to 1884 was 441, when Prussia's was 22. Are we to infer that Prussia is just twenty times as sanitary as Belgium? In the year 1886 the death rate from smallpox of Switzerland was fifty-fourfold that of Germany; that of Belgium, forty-eightfold; Austria eighty-onefold; and Hungary, six hundred and sevenfold.

In Italy, registration of causes of death was initiated in 1881. A compulsory law of vaccination in infancy, and revaccination of all the children attending public schools, was instituted in 1888. The smallpox deaths per 100,000 inhabitants from 1881 to 1890 averaged 35.5, being during but two years below 20. From 1891 to 1894 the average

was 6.5. In the four great capitals of Europe, in ten years from 1877 to 1886, the smallpox deaths per 100,000 living were as follows: Vienna, 67; Paris, 28; London, 25; Berlin, 1.

In several localities in England a strong anti-vaccination sentiment has arisen, and by the irony of fate these towns furnish some very wholesome lessons. In the Sheffield epidemic of 1887-88, we have the following statistics as given by the *Practitioner:*

Attack rate per 1,000 in	non-vaccinated,	94;	death rate	51
" " "	once vaccinated,	19;	" "	1
" " "	revaccinated,	3;	" "	.08

One in 1,300 of the vaccinated died; one in 20 of the unvaccinated.

In Gloucester the anti-vaccination sentiment had been particularly strong, and in the epidemic of 1895-96 there were 1,979 cases and 439 deaths in a population of 42,000. Strenuous attempts were made to stay the epidemic by means of hospitals, disinfection, and quarantine, without the slightest effect. It raged unchecked until officials who had publicly and boastingly declared themselves opposed to vaccination became panic-stricken and, turning directly about, enforced the vaccination laws. The epidemic was then rapidly quelled.

Statistics derived from armies are of particular

value, for there is no chance for the concealment of cases, which frequently occurs in civil life. Every case of disease, as well as every death, is known. Beginning with 1874, the average annual death rate per 100,000 strength in various armies was as follows: French army for eight years, 15; Austrian army for six years, 26; British army for twenty years, 3.7; Prussian army, one solitary death from 1874 to 1896. I have not been able to obtain the statistics since that year. As already stated, vaccination is more thoroughly carried out in the Prussian army than among any other like body of men, the British army standing next.

Smallpox hospitals also furnish their evidence of the efficacy of vaccination. Doctor William M. Welch, in an experience of twenty-five years as physician to the Municipal Hospital of Philadelphia, reports that no physician, nurse, or employee of that institution, vaccinated before beginning duty, ever contracted smallpox. Doctor Marson, physician to the London Smallpox Hospital, said: "In thirty-five years I have never had a servant or nurse with smallpox; I revaccinate them when they come here." In his classic article based upon observations made upon 5,982 patients, he reports a mortality of 35.55 per cent. in patients never vaccinated, and 5.25 per cent.

in those who had been vaccinated once and showed a scar. Doctor Collie says that during the epidemic of 1871, out of 110 smallpox attendants at Homerton, all but two were revaccinated, and those two alone took smallpox. MacVail collected statistics of 1,500 smallpox attendants, forty-three of whom had smallpox, but not one of the forty-three had been revaccinated. Doctor Bracken, of Minneapolis, has this year reported 662 cases of smallpox, but ten having ever been vaccinated. Of these ten, twenty years or more had elapsed since the vaccination in seven.

The Chicago Board of Health has recently made the following statement: "Out of a total of 171 cases of smallpox found in Chicago between November 30, 1900, and April 10, 1901, 140 had never been vaccinated. Of the remaining thirty-one cases, twenty-nine were adults, showing faint, poor, or irregular scars, claimed to be evidence of attempted vaccination in infancy or childhood, the most recent being twenty-three years old. Only two out of the 171 cases exhibited scars of successful vaccination." Vaccination was made compulsory in the Chicago schools in 1867. From 1867 to 1881 there were but seventeen cases of smallpox. After 1881 there was not a single case for ten years, when four developed. These

children had been passed on fraudulent certificates, as neither of them could present a scar. In St. Paul, between May 1, 1899, and May 10, 1901, there were 104 cases of smallpox. Of these, but two had ever been vaccinated, one fifteen and one twenty years before. Doctor P. M. Hall, of Minneapolis, treated 191 cases between January 7 and May 8, 1901. In one only could signs of vaccination be found. Individual experiences of this character could be quoted indefinitely.

One of the most positive demonstrations of the power of vaccination has recently been afforded by experience in Porto Rico. In October, 1898, smallpox was endemic; in December it was epidemic; in January it had honeycombed the island; in February there were more than 3,000 recent cases, and the disease was spreading at a gallop. By order of General Henry a systematic compulsory vaccination was begun. This was carried out by the medical officers of the army. The vaccination was begun simultaneously in all parts of the island. The work was done scientifically, as work by the medical corps of the army is always done, and was carefully recorded. In a population of 960,000, more than 860,000 were vaccinated. Of these, 87.5 per cent. were successful. The work was completed July 1st. The average number of

deaths from smallpox in the ten years preceding that date was 621, there being 3,000 cases when the work was begun. The number of deaths in the two and one-half years following that date have been at the rate of *two* per annum. This work, scientifically done and recorded in an island under military control, furnishes absolutely authentic data, the correctness of which cannot be questioned.

Another very recent demonstration of the effect of vaccination is that afforded by Cleveland. Early in 1902 the Health Officer of that city discontinued vaccination, and announced that hereafter he would rely wholly on disinfection. This action was taken at the beginning of the warm season, just as an epidemic was passing away, there being but twenty cases of smallpox in the city. The disease continued to diminish, and the anti-vaccinationists were loud in their assertion that this was a demonstration that disinfection was the only safeguard needed. As a matter of fact, inflammable material was thus allowed to collect, to be ignited at the first spark of infection. That result came sooner than might have been expected. According to the report of the Marine Hospital service on August 8, 1902, there was and had been for some time more smallpox in Cleveland

than in any other city of the country. It is needless to say that public vaccination has been resumed in that city.

The statement is frequently made that smallpox has become a much milder disease than it formerly was, and that vaccination, therefore, is less necessary. Facts do not bear out this statement. It is quite true that during the recent epidemic the death rate in some localities has been extremely low, and the illness has been mild. It has, however, not been universally so. It is true of all epidemic diseases, that the prevailing type varies considerably in different years, and smallpox has certainly not of late shown itself in its most virulent forms. Another factor is to be considered as accounting for its mildness. It is not noticeable that the term "varioloid" is now but seldom used. All attacks are now called smallpox, a tendency to be commended. It remains true, however, that a great many cases have been reported as smallpox which in the past would have been described as varioloid. In those who have never been vaccinated, the disease in most epidemics is almost, if not quite, as dangerous as it ever has been. In the London Smallpox Hospital, between 1775 and 1800, all patients, of course, being unvaccinated, the mortality rate

was 32.5 per cent. In 1853 Marson found that the rate of the previous sixteen years was 35.55 for the unvaccinated. In a recent study of smallpox, Welch reports 1,512 cases in unvaccinated persons, with a death rate of more than 58 per cent. In young children the rate was much higher than this. Hart gives the death rate of unvaccinated patients as fully 40 per cent. In the Sheffield epidemic of 1887, the death rate was 51 per cent.

The statement sometimes heard, that scarlet fever is as dangerous as smallpox, is unwarranted. After an extensive study of American and European cases, Holt states that the general death rate from scarlet fever is from 12 to 14 per cent., and from 20 to 30 per cent. under five years. This is less than half the most favourable rate given for smallpox. The sequels of scarlet fever, though often grave, are not to be compared with those of smallpox. A hundred years ago two-thirds of the inmates of the blind asylums had lost their sight from smallpox. Blindness, deafness, lung disease, tuberculosis, general ruin of the constitution, and personal disfigurement are the common results. In fact, the ravages of the disease cannot be estimated by the number it kills.

Under our form of government, it seems almost impossible to hope that compulsory vaccination

will ever be attained and enforced. The dread of abridging the personal liberty of the few often leads us into neglecting the rights of the many. It is only by persistently educating succeeding generations that anything like adequate vaccination of the community at large will be accomplished. It seems also that the lesson must occasionally be enforced by the bitter experiences of a more or less fatal epidemic.

Experience of more than a century has confirmed and strengthened the teachings of Jenner, except upon the single point of the duration of immunity. Some of the lessons taught may be summarized as follows.

1. The first lesson cannot be better stated than in the words of the Berlin Board of Health: "Vaccination in infancy, renewed at the end of childhood, renders an individual practically as safe from death by smallpox as if that disease had been survived in childhood, and almost as safe from attack."

2. The duration of immunity conferred by vaccination is variable. In many individuals, vaccination in infancy and revaccination in childhood is sufficient for life protection. In a limited number immunity is lost after five or six years. It is never possible to know with certainty to which

class an individual belongs. In the face of an epidemic, therefore, vaccination of all who have not been vaccinated within five or six years is giving what the lawyers call the benefit of a reasonable doubt. Every one who has been vaccinated in infancy and childhood should be vaccinated not less than once in adult life.

3. The immunity conferred by vaccination is in direct proportion to the thoroughness with which it is performed, and this is shown with considerable accuracy by the character and number of resulting scars.

4. The mild compulsion enforced in this country, by requiring vaccination or evidence of its recent performance upon admission to the public schools, should have the hearty support of parents and physicians alike.

The statistics and facts pertaining to the history of smallpox and vaccination recorded in the foregoing pages were derived from the following sources, where every statement may be verified:

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CHAPTER VIII

The Effect of Modern Life Upon Disease

The diseases of a people are modified from generation to generation by the changing habits of life, and never have such radical changes taken place as those in this country during the past half century. From a community largely agricultural, with no large cities, population has trebled, and the country has developed into a great commercial and manufacturing nation. Until the present generation of active workers, the chief task of the American people was the subduing of the continent. The American spent his life out-of-doors. On the frontier, which but yesterday disappeared, his life was rough and vigorous, and one of constant physical endeavour. In the wake of the frontier were the long stretches of farms and rural communities, followed later by ranches and mining camps, all demanding the life of physical toil and open-air labour. This work of continent subduing began the day the Puritans landed in New England and the Cavaliers in Virginia, and did not cease until

the Pacific had been reached. For two hundred and fifty years the young men and women of the country left the older regions of the East in yearly swarms, as bees leave the parent hive. Ever pushing westward, they developed a race as hardy and vigorous as ever conquered savage or tilled the soil. Whoever says the American is not a hardy race ignores facts.

In the meantime it had become a homogeneous people. Until 1820 immigration was slight, and rarely exceeded 6,000 a year. During the next twenty-five years the average yearly immigration was little more than 42,000. About 1847, however, a sudden change occurred, and the yearly arrivals have since been counted by hundreds of thousands, at times approaching the half-million mark. These foreign peoples have penetrated into the remotest localities, carrying with them their own physical peculiarities and diseases.

Vast cities have come into existence, and to-day there are several in what was the frontier of fifty years ago that are larger than was the metropolis of that day. Overcrowding in the centres of population has become the rule. New York enjoys the bad distinction of possessing several of the densest populated acres in the world. An overcrowded population carries with it its own diseases. Many

of the diseased conditions seen by the physicians of public dispensaries and hospitals are either unknown in well-to-do private practice or appear in radically different form.

Overcrowding shows its effects in the well-to-do portions of large cities as well as in the tenement regions. The tendency to gregariousness is seen everywhere. The farmer leaves the farm and goes into the village, where his mode of life materially changes. It becomes less active, if not actually sedentary. In this he illustrates the whole tendency of modern life among the better-to-do; the abandoning of physical labour and the adoption of callings which less and less require an out-of-door life and manual labour. Agriculture and manufacturing are done more and more by machinery. The labourer in these fields becomes less a labourer and more a passive attendant upon a machine. The young, both men and women, seek the factory, the shop, the store, the business office, the professions, and the vast army of sedentary people becomes more vast year by year.

These changes are to a certain degree world-wide, but in no other country have they been so rapid as in America. From a largely agricultural people with scarcely a suggestion of a leisure class, we are becoming a cosmopolitan nation with a steadily

increasing leisure class. Added to this is the tremendous tension under which our newly found tasks are being done. Here we have fruitful sources of new diseases and modifications of the old.

In the matter of adapting themselves to new conditions, the intelligent are sometimes but little in advance of the less intelligent masses. People are just beginning to learn that new conditions of life demand new methods of living, that sedentary lives within brick walls are producing effects which their grandfathers never experienced. They are beginning to see that a few months of modern commercial life are more exhausting than were as many years of the old village life of the North or the plantation life of the South. Golf and tennis would have been absurdities in Colonial times, for the people did too much physical labour. The regular summer vacation or a tramp in the mountains was then unnecessary, for the people, even of the cities, walked or rode horseback most of the time. The men of old computed their business in thousands; they walked home at noon and ate dinner in a rational way. They required few vacations. The men of to-day compute their business in millions; they eat that abomination known as a "quick lunch," and employ a labour-saving machine called a typewriter which enables them

to write six times as many letters a day, and thus load their mental faculties with six times as much business.

Golf, tennis, and the bicycle, as well as outings and summer vacations, are expressions of a rational appreciation that the times have changed. The tendency to get back to the land, to become more intimate with the country, and escape from the city for a part of the year, is constantly becoming stronger. It is doing much to neutralize the evils which necessarily result from the crowding of the population into vast cities. Three or four decades ago only a few of the wealthiest Americans living in the cities owned homes in the country. Now such a home is by no means an indication of great wealth. Thousands of families of moderate means have a little home in the country, a cottage at the seashore, or a camp in the mountains to which they go early and return late. The tendency shown by all classes to escape from the cities for a part of the year is a fortunate and beneficent one.

While there has been a more or less marked decrease in the frequency of almost every disease during the past twenty-five years, three classes of diseases have increased. These three classes are: fatty degenerations, kidney disease, and cancer. Myocarditis, or degeneration of the heart muscle,

has increased 150 per cent., while the population has increased but 50 per cent. Disease of the arteries, which is degenerative in nature, has markedly increased. Certain forms of Bright's disease have almost doubled. The power of alcohol in the form of malt liquors to produce degenerative changes is so well known to pathologists, that the conclusion is irresistible that the radical increase in these diseases comes largely from changed drinking habits. Certain conditions which result from the excessive use of distilled liquors have not increased. Cirrhosis of the liver, long known as "gin-drinker's liver," has relatively diminished. This disease is usually the result of the excessive use of whisky or brandy. Since 1883, with an increase in the population of about 50 per cent., the consumption of distilled spirits has increased but 30 per cent. It is impossible to adequately consider the diseases of a people without considering their drinking habits, for alcoholism is one of the most important predisposing causes of many forms of disease.

Between 1890 and 1900 the census shows a decrease in the following diseases per 100,000 population: consumption from 245 to 190; diarrheal diseases from 104 to 85; diphtheria from 70.1 to 35.4; typhoid fever from 46 to 33; mem-

branous croup from 27 to 9; malarial fever from 19 to 8. An increase is shown in the following diseases: pneumonia from 186 to 191; heart disease from 121 to 134; kidney disease from 59 to 83; apoplexy from 49 to 66; cancer from 47 to 60; diabetes from 5 to 9.

Americans are not intemperate as a people. Statistics all show that their consumption of beer, wine, and spirits is comparatively small. Bence-Jones says that, with the exception of Canada, the consumption of alcohol in the United States is the smallest of any large nation. In 1890 the consumption of spirits per head was 1.17 gallons; in 1898 it had fallen to .92 of a gallon. While the use of beer had increased, it was but thirteen gallons per year per head. At the same time it was thirty-two gallons in Great Britain, twenty-seven gallons in all Germany, and fifty-six gallons in Bavaria. Schooling has recently presented statistics in which he shows that the use of wine and spirits in America is small, while the use of beer is not half that of Germany and England. He believes that the alertness and prompt energy of the American may be due in part to this relative abstinence from alcoholic drink. The most serious aspect of the drink problem in this country is the increasing tendency to drink to excess shown

by the women of the more intelligent and educated classes. What will be the future of a people whose mothers are drunken?

The immigration of beer-drinking peoples will result in the increased average consumption of beer in the future, and will teach our people the same habit. The brewing industries of this country need the close supervision they have in Germany. Much of the beer sold is so adulterated that it is unfit to put into the human body. Indeed, the same is true of much of the wine and brandy, and even the whisky, sold in shops and saloons.

There are interesting contrasts in the comparative vitality of the sexes. Symonds, of New York, has recently made a study of the statistics obtained by life insurance companies. He confirms Farr's statement that women have a greater expectation of life at every age than men. During the first year female mortality is decidedly less than the male. Although more boys are born than girls, the great mortality among them reduces the proportionate number to a balance in favour of the females. When he is five years old a boy goes out-of-doors more. The girl, in the meantime, is kept in the house, and her mortality begins to rise, and for a time passes that of the boy. The ten years between forty-five and fifty-five is commonly

regarded as a critical period for women. The actual increase in mortality, however, is not more than in previous years. On the other hand, the male mortality rises rapidly during this period. Between fifty-five and sixty the female mortality increases, but after this age the two rates run along in parallel lines, the female being always less than the male. Insurance tables also show that the largest number of deaths in men occur between the fortieth and fiftieth years of life; the next largest number between the fiftieth and sixtieth years. The large mortality rate at this period of life is the logical result of twenty-five years of struggle in business or professional life. The overstrenuous life untempered by reason cannot continue indefinitely.

The diseases that have been brought most completely under control by improved treatment and sanitary measures are not those of middle life, unfortunately for the individual who has reached that age. Medical science has done much to make life safe up to the age of twenty. Mortality during the first five years is always high, but has been greatly lowered. During the second five years it suddenly diminishes. From ten to fifteen it is lower than at any other period of life. From fifteen to twenty it is but little higher. At twenty,

however, the individual must begin the race with disease. At first he may meet with typhoid fever, tuberculosis, pneumonia, acute rheumatism, dyspepsia, and appendicitis. At forty-five he enters upon the period of greater tendency to heart disease, kidney disease, cancer, diabetes, alcoholism, digestive diseases, chronic rheumatism, and gout. A little later he enters the period of arterial diseases, apoplexy, and certain degenerative changes.

At every age life may be cut short by the destructive forces utilized by modern civilization. A man may be electrocuted by live wires in the streets, or hurled to destruction by dynamite. He may be smothered in a fire-proof hotel, or dashed to death in a falling elevator. He may be run over by bicycles, trolley cars, or automobiles, or crushed in a railway accident. These causes of death have an appreciable effect upon the mortality tables. According to the reports of the Interstate Commerce Commission, during the ten years ending 1900, 68,837 people were killed on the railroads of the United States, and 387,803 were injured. Many cases were probably not reported. And this is but one mode of accident. After forty-five, death by accident becomes relatively more common. In fact, after that age statistics show

that a man is twice as liable to die from accident as from old age. In later life accident is one of the common causes of death.

Another cause of death, more frequent now than it was formerly, is suicide. Between 1890 and 1900 the ratio per 100,000 population in the fifty largest cities of this country increased from 12 to 16.6. The Mutual Life Insurance Company reports that the proportion of suicide to all deaths has increased from 1.9 per cent. to 2.4 per cent. in the last fifty years. The popular impression that the loneliness of farm life induces suicide is disproved by the fact that the rate for large cities was 16.6 while that of the whole country was 11.8. It is a curious fact that the frequency of suicide varies greatly in different cities. In the decade ending in 1900 it ranged from 31.1 per 100,000 in San Francisco to 23.3 in Chicago, 15.4 in Boston, 13.6 in New York, 5.1 in Trenton, and 2.9 in Fall River. Among the large European cities, Paris stands first in the number of suicides, the rate being 42, while that of Berlin is 36, Vienna 28, London 23, Rome 8, St. Petersburg 7, and Madrid 3. Among the foreign countries the highest rate is in Saxony, where it is 31.1, that of Austria being 21.2, France 15.7, Prussia 13.5, and England 6.9. In the forty-five largest American cities, between

1890 and 1900, there was a total of 15,144 known suicides.

There can be but little doubt that the historian of the future will look back to the nineteenth century as a marvelous one. One of the notable facts which will attract his attention will be the remarkable increase in the population of the civilized world. It is estimated that during the century the world's population increased from 950,000,000 to 1,558,000,000. This increase was confined to the civilized countries and those coming directly under their influence. It is a common error on this side of the Atlantic to believe that America is the only country that has shown a great increase of population. When William the Conqueror landed in England in 1068 he found a population in that country and Wales of but 2,150,000. During six hundred years the population but little more than doubled, and as late as 1800 numbered but 8,500,000. In 1900 it had increased to about 32,500,000. The population of Germany increased from 24,800,000 in 1816 to 53,300,000 in 1900. The population of Japan has increased 14,000,000 since 1870, and similar changes are shown in other countries. The only country of Europe which has shown an actual diminution of population is Ireland.

Increase in population may result from three causes, acting alone or together—increased birth rate, decreased death rate, immigration. While immigration has aided in increasing the population of America and Australia, it has tended to diminish that of Europe. A study of vital statistics soon shows that throughout the civilized world there has been during the past half century not only a decrease in marriages, but also a decrease in the number of births per marriage. That is, the birth rate has visibly diminished. This means that the remarkable increase in the population must have been the result of a diminished death rate. This is confirmed by vital statistics. Wherever modern civilization has gone, there has followed a decrease in the death rate and an increase in the population. During the eighteenth century the annual death-rate per 1,000 of population was nowhere under 50; it was often 70 or 80. In 1900 the average death rate for the "registration" cities of the United States was 18.6. In 1620 the death rate in London per 1,000 was more than 70, and the average duration of life was but fifteen years, owing in part to the enormous infant mortality. In the next one hundred and fifty years the average duration of life increased but four years. In 1835 the death rate had fallen to 32 per 1,000, and the

duration of life had increased to almost thirty years, and has become much longer since. In the United States the average age at death in 1890 was 31.1 years. In 1900 it was 35.2 years. These are but a few facts to show how diseases have changed under the influence of sanitary and medical science.

Three hundred years ago almost twice as many people died every year in London from smallpox, plague, dysentery, and cholera as now die from all causes combined. These diseases, as well as typhus fever, leprosy, and yellow fever, may almost be called extinct diseases in civilized countries. Combined, they form but an insignificant fraction of the mortality rate. Deaths from diphtheria, typhoid fever, malarial fever, and the summer diseases of children have been greatly reduced during the past decade. Tuberculosis remains as the greatest destroyer of human life, for it causes fully one-fourth of all the diseases and deaths at the most important period of life, from fifteen to fifty years. It is the diseases against which sanitarians are directing their most active efforts, and their labours have already borne fruit. When we consider the financial aspect alone of the loss of so many valuable lives, the indifference of legislators and their disinclination to expend

money to aid in suppressing tuberculosis seems very strange.

About one hundred years ago Malthus promulgated the doctrine that population naturally increases in a geometrical ratio, while the means of subsistence increases only in an arithmetical ratio. He further held that vice and crime, wars and cataclysms, epidemics and plagues are the measures adopted by nature to restrict population within safe bounds. The Malthusian doctrine was quite generally accepted by political economists of the early nineteenth century. Its overthrow in the latter half of the century is perhaps more apparent than real. It still holds true of uncivilized nations. Civilization has not only been followed by increased population, but thus far by increased prosperity. Not only has wealth increased, but the wages of labour have increased during the last half of the century, in some countries as much as 133 per cent. and even more. The people of the civilized world live far better to-day than they did a century ago. These results have been due to causes which Malthus could not have foreseen. He could not know of the evolution of modern science and its application to the relief of human wants, especially in the production of food. Commercial expansion has made the food products of remote regions

available. Steam and electricity have brought the granaries of the world to the very gates of the great cities. Otherwise they could not exist. Equity and justice, and the elevation of moral standards, have reduced crime and pauperism, and removed certain causes of early death. Improved sanitation, and the increased efficiency of medical science, have also produced results that could not have been foreseen a century ago. Smallpox alone caused 60,000,000 deaths in Europe during the eighteenth century, and the victims were largely children.

One of the most certain indications of the civilization of a people is the care it bestows upon infancy and childhood. The attention devoted to the management of infants and the rearing and education of children is a marked characteristic of modern civilization. It has resulted in a large saving of child life, and has been no small factor in bringing about increase in population. The emancipation and elevation of womanhood was another characteristic feature of nineteenth century civilization, and resulted in increased material prosperity. It was a necessary preliminary to the improved care of children. "The hand that rocks the cradle rules the world." More intelligent care on the part of the mothers has been a factor, not alone

in saving the lives of infants, but in rearing them to sturdy manhood and womanhood. The "advanced woman" of recent times does some foolish things, and does not always use her new-found liberty judiciously, but her general influence has been for good, and she has been an active agent in advancing civilization. Her influence has always been thrown on the side of improved sanitation and hygiene, and she is ever a valuable aid in carrying out the measures of preventive medicine.

The people of to-day are more temperate than they were a century ago, and thus another cause of disease and abbreviated life is reduced. Total abstinence is now demanded of employees by thousands of employers and great corporations. Never before in history has strict temperance been practised by so large a portion of the population of a great nation as in the United States to-day. Finally, preventive medicine has had a large and honorable share in setting at nought the cruel and pitiless doctrine of Malthus.

A great decrease has recently been shown in some of the most prevalent diseases of large cities. Infant mortality must always be large, but the improvement shown during the last forty years is extraordinary. During the first eight years after the organization of the Health Department of

New York in 1866 it averaged 123.3 in each thousand children. This has steadily fallen to 64.8, a decrease of almost 50 per cent. In 1866 the death rate for the contagious diseases, tuberculosis, and diarrheal diseases was 13.2 per thousand. It fell to but 11.8 for ten years preceding 1883, but has since decreased to 6.4, a diminution of more than 50 per cent. These results are due to several causes, the most important probably being the diminished death rate from diphtheria due to the use of antitoxin, decrease in the occurrence of tuberculosis, and a marked decrease in the occurrence of the summer diarrheas of children. Much has been accomplished by improved methods of treatment, better methods in the care of children, and of those suffering from contagious diseases, an improved milk supply, cleaner streets, and improved conditions in many tenement regions.

A study of life tables recently made by Roger S. Tracy, of the New York Board of Health, proves that a child born to-day has an expectation of life nearly four years longer than the child born fifty years ago had. This increased expectation continues during the early years of childhood. It then gradually diminishes, until at thirty-five it is virtually the same as that of the older period. After the age of forty or forty-five it becomes actually

less, and a man at this age has a less expectation of life than did his grandfather.

These strange facts, it has been suggested, are due to two causes. First, the saving of child life undoubtedly throws forward into adult life a certain number of weakly individuals who succumb at middle age in the struggle for existence. This is probably counteracted, however, by the better condition in which the average modern child enters upon life, owing to wiser methods of care. Second, as to the expectation of life, after middle age, the strain of existence is becoming constantly greater and has a visible effect. There is, besides, a growing tendency in many grades of society toward self-indulgence and neglect of methods of right living. "Few people," says Tracy, "have enough self-control to become centenarians." There are, moreover, certain contagious diseases which are becoming more prevalent in this country.

Two very important facts are brought out by the statistics just presented—the saving of life in its early stages and the sacrificing of life in its later stages. These must be due to well-defined causes. If so many infant lives may be saved, it is the duty of parents to make themselves familiar with the helpful methods. If the lives of the middle-aged are being unnecessarily sacrificed, as they certainly

are, it is the duty of the individual to ascertain the causes and endeavour to avoid them. In the pages that follow I have endeavoured to throw some light on both these subjects.

CHAPTER IX

The Rearing of Children

"It is babyhood that has made man what he is," says John Fiske. This is a concise statement of a most important fact. To man of all animals has been granted the longest period of development, during which he is plastic and capable of being moulded. Not only is the developmental period actually the longest, with but one or two possible exceptions, but relatively it is far the longest. Even if a man attain his full span of threescore and ten years, a full third of it must be devoted to development and preparation for the other two-thirds. The difference between man and the lower animals is admirably shown by Fiske in his illustration of the codfish. "Its acts are mostly concerned with the securing of food and the avoidance of danger. These acts are few in kind, and require for their performance a very slight intelligence. Its experiences, while numerous enough, are so much of a kind that practically they require only the monotonous repetition of the same few acts. So few are these acts, and so

limited the nervous connections necessary to their proper performance, that they become established by heredity, and the young codfish enters upon its life capable of performing all of them about as well as its ancestors. It has little to learn by experience. It requires no education. It has no infancy."

As we ascend in the scale of animal life, we reach a grade of development which cannot be fully attained before birth. It must be largely gained by growth and education after birth. This period we call infancy. Another illustration of Fiske's is admirable in making clear this point. "The young puppy," he says, "is quite helpless at birth. But his infancy is short, and he soon crystalizes into an adult dog. Yet short as is the infancy of this species, dog-fanciers have taken advantage of it, and by careful training and selection have developed many interesting varieties of this animal. These men fully recognize that the period of infancy is that of plasticity, for they say, 'It is hard to teach old dogs new tricks.' The acts of the adult animal of this species are so simple that a short infancy is all that is necessary to gain the experience and adjust the nervous connections required for the performance of the adult acts."

As we go higher in the scale, we find that the greater the intelligence and the more complete the life the longer is the period of infancy. The manlike apes of the highest order are helpless at birth, and have an infancy of considerable length. Coming to man, we find that at least twenty-five years are necessary for the attainment of full physical and mental development. The State, in regarding its citizens as "infants" until the age of twenty-one years, is certainly not demanding too much.

While this slow development is true of the physical man, it is doubly true of the mental man. There is a peculiar asymmetry between his normal mental and physical development. At one year of age, the infant possesses almost two-thirds the brain substance of the adult, but the functional capacity is not the one-hundreth part of what it will be after twenty years of education and experience. At ten years the brain has attained almost its full size, and it is not uncommon to see a boy of that age who is able to wear his father's hat. But long years of education must follow before he can be entrusted with his father's business or professional affairs. And that power will not come by itself; it is not inborn. It must be developed.

To what practical point does this lead, and what does it teach? It presents the very real fact that a tremendous responsibility is placed upon every parent upon the birth of a child. This, happily, is fully appreciated by the majority of American parents, and it is unnecessary to add to the weight of that feeling of responsibility. But the most conscientious may make errors. The mistake is often made in believing too much in inheritance and the power of heredity. There are very few natural Little Lord Fauntleroys. It should not be forgotten, moreover, that the winning qualities of that attractive little character were supposed to be due only in part to inheritance from his gentlemanly father. They were far more the result of the careful training of a devoted and very clever mother. That touch of nature was a stroke of true genius, both in the book and its dramatic presentation. Inherited capacity for a generous and noble life, developed by persistent training by a mother capable of appreciating and living such a life herself, made the character what it was. That little book, commonly classed as a children's book, might receive a sub-title, "A Guide for Parents."

An error in the training of children, not uncommon, but always fatal when it occurs, is the belief

that a child will possess certain qualities of character naturally and without training. Because a child is of gentle stock it does not necessarily follow that he will be a gentleman, giving to that term the American meaning. The only safe course is to begin young and train him persistently in the ways of true gentility. "Born gentlemen" are rare in this world. Most of those who pass by that name were trained infants. Courtesy, polish, tact, and knowledge of social and worldly ways, are necessary to a gentleman. They are the superficial evidences which upon first acquaintance are the most apparent. But in addition to this, a real gentleman is unselfish, thoughtful for others, honourable, generous, and kind. But these qualities must be developed during the first years of life or in many cases they will never develop. Honour and generosity, as opposed to deceit, indirection, shiftiness, and meanness, are qualities that can be vastly increased by precept and example. Unselfishness, and regard for the comfort as well as the rights of others, are qualities that can be developed or repressed by training more than almost any others. The most generous nature can be rendered absolutely selfish by training. The parents who habitually sacrifice themselves wholly to the child, and make the whole house-

hold subservient to him, are deliberately educating him to selfishness and meanness. Much more selfishness is created in this world by training than is born into it.

Who can know the whole importance of those first plastic years? The teachings of those years can never be wholly eradicated. We speak of our inborn religious beliefs. They were mostly instilled into us by our mothers before we were fairly out of our cradles. In nothing does the Catholic Church show its wisdom more clearly, and its knowledge of human nature, than in its care for the young. Put a child under devout Catholic influence during its first half dozen years, and it is always a Catholic. The fundamental principles you implant in your child during those years will form the basis of his character thereafter. What you train him to be during his first fifteen years, that he will be to the end of his life. He will develop and grow, perhaps, beyond all expectation; he will outgrow some characteristics, and change in others; he may take some sudden turn which you in your blindness did not expect; but with few exceptions the character he has at sixteen he will carry with him through life.

The meaning of heredity is largely misunderstood. Much less is inherited than many people

suppose. A *capacity* is inherited which is capable of development by education, experience, or observation. Paderewski must certainly have an innate ability as a pianist. He probably inherited a capacity for that art, but he did not inherit the art he possesses to-day. His natural capacity has been developed by unremitting toil such as few artists have been willing to undergo. And thus it is with most talents which lead to success in life. In the vast majority of cases they must be developed. An occasional genius succeeds without much training, but a genius is an anomaly, and an exception to all rules. The rule is, that an inborn talent, to be of any value to its possessor, must be developed and expanded during the formative years of life.

The discrepancy between the physical and mental growth in man, to which reference has already been made, is far less noticeable in the lower animals. The nervous system of the child is normally immature, and incapable of doing sustained mental work without injury. The child that deviates from the physiological condition by showing remarkable mental precosity is an abnormal child, and one that must be carefully and tactfully restrained if the best mental and physical development is to be hoped for. The young

of birds and certain animals are very precocious; they care for themselves within a few days, and reach their full development within a few weeks. As we go higher in the scale of development, the young are less precocious. In the higher monkey tribes, it requires from six to ten years to reach full mental and intellectual development. In certain of the African races the span of life is thirty years. The children of these savages are very precocious; they walk early, and reach physical and intellectual development at about ten years. Many Negro children are phenomenally precocious, while Caucasian infants of civilized countries are, mentally, the least precocious of all creatures.

Precocity may result from a number of causes, and may be divided into more or less distinct types, the recognition of which is important in the care and training of children. Two types are particularly referred to by Doctor Rachford, who has made an extended study of this subject. In the first of these are those precocious children of good physique, who have inherited from an intellectual parentage unusually active nerve centres. This form of mental precocity may be associated with good physical development. Such children are, as a rule, encouraged, or at least not

discouraged, and as a result the mental functions are forced into a premature maturity, which does not conduce to intellectual vigour in after years. They live in an intellectual atmosphere much above their years, and do not, as a rule, delight in the sports of children of their own age. If properly guarded and restrained during childhood, such children are capable of the highest intellectual development in after life; they can be moulded into the highest type of symmetry, or they can be dwarfed, by excessive intellectual activity, into mental mediocrity.

In the second class are the precocious children of an altogether different type. These are children of poor physique, who have inherited physical weakness or actual disease. They are often of gouty or tuberculous families, frail of body and fair of skin, beautiful and bright-eyed. They are, as a rule, affectionate, lovable, and mentally precocious. But their delicacy of constitution is such that they are incapable of sustained intellectual effort. Their precocity is fitful, and lacking in symmetry. It is common for them to have a remarkable memory, which is developed at the expense of their other mental faculties. The child mathematicians, poets, and musicians, as a rule, belong to this class. Early in life they exhaust

their mental energy in the development of a single faculty, and then lapse into mediocrity. Precocious children of this type need intelligent restraint and direction throughout the whole period of childhood. The chief aim in the management of such children should be the improvement of the physical and the restraint of the intellectual development.

The rearing of children involves the great question of education, which means something far more than schooling. Herbert Spencer mentions five objects to be attained in the education of children: that education which prepares for direct self-preservation; for indirect self-preservation; for parenthood; for citizenship; for the miscellaneous refinements of life.

Direct self-preservation is the most important lesson which a child should learn. By the knowledge he learns to take care of himself and to protect himself from injury and disease. A child who always has a nurse or governess at its elbow meets with as many accidents as one who is obliged to take care of himself. He fails to learn the important lesson of self-preservation. The education which prepares for indirect self-preservation consists in the mastery of that knowledge which is necessary in gaining a livelihood. This is regarded

by many as the most important object of education, and is too often considered the only object. It has been overdone in recent years. The education which prepares for parenthood is clearly of the utmost importance to the future well-being, not only of the individual, but of the race, and is almost universally neglected. The fourth division, which includes the teaching of political and moral science, is universally acknowledged to be of great importance. Yet it is often neglected in colleges and higher schools. In a country where the government is vested in the people, its importance is especially great. The last division has too often been permitted to usurp the time which might be devoted to other objects to better advantage. Some schools and colleges have made it almost the sole object of their efforts. This is happily becoming less true in this country. The pendulum has, in fact, been in some cases allowed to swing too far in the other direction. In the effort to render education "practical," that training which develops culture and refinement has been neglected. That education is unquestionably best which best enables the individual to protect himself and gain a competent livelihood, at the same time preparing him for the important duties of parenthood and citizenship and enabling

him to appreciate and enjoy those refinements of life which lighten and brighten the daily toil to which most of us are assigned by destiny.

The rearing of children is easy only in books. The writing of a chapter like this, therefore, is an easy task. The actualities to which it refers are practically very difficult. They may be made a little less difficult, perhaps, by some suggestions from a medical practitioner whose duties take him day by day within the inner circle of many families, where he must needs observe the successes and the errors that are made in the management of children. The successes, he is bound to say, have, in his experience, outnumbered the failures. In view of the difficulties of rearing children in great cities, the results attained are remarkably good. The good mothers far outnumber the poor ones. Errors result almost universally from lack of experience, not from lack of desire to do the best. Among the well-to-do the indifferent and careless mother is very rare. The chief exceptions to this rule are found among those women who make society the first object of their lives, and become overwhelmed with its cares and duties. To the statement sometimes heard, that the modern mother is growing indifferent to her children, I would enter a vigorous protest. It is not true.

The mother of to-day is what the mother has been in all time—devoted, loving, and true, ever ready to sacrifice her own comfort for her child, and to place its interests before her own. Errors are largely those of inexperience or of judgment, not of indifference or wrong intent.

The fact is often forgotten that the mother of to-day has a much more difficult task than had her grandmother. Under the simple conditions in which our grandparents and great-grandparents lived, the rearing of children was an easier task than it is under the complex civilization of to-day. We are not at fault for this, but must take things as we find them and make the best of them, even if our grandmothers criticize our way of doing it. We were born into this modern life and are but units in its great rushing current. We can no more stop it or change it than we can stop the flow of the river by damming back a few of its drops. We are here in the midst of changing conditions, We have ourselves suffered as well as profited by them; and our children, unfortunately, must suffer as well as profit by the changes that have occurred since our childhood.

It cannot be demonstrated that the parental training of to-day is inferior to that of the past. Many of the most prevalent errors are due to the

times and the changed conditions of life. As a matter of fact, children are receiving far more attention and rational care than they formerly did. To the student of sociology, one of the most notable features of the past few decades is the growing attention bestowed upon children. The thought now devoted to them would have amazed our ancestors of three generations ago. Thousands of men and women are being trained in normal schools for the one purpose of instructing the young, for the work of the teacher is now believed to be one demanding extensive and peculiar education. Volumes are written annually for children and of children, while journals and magazines of the same character have increased a hundredfold. The children are considered a far more important factor in every family than they were fifty years ago.

This tendency to bestow more attention upon children, and more thought upon their care and education and training, is not to be criticized, but it cannot be denied that the matter in many families is carried to an injudicious extreme. Neither can it be denied that the general tendency is in the direction of bringing the children into too great prominence, in making them the most important and first-to-be-considered members of the

family, and in laying burdens upon them too great for their strength. These errors are undoubtedly greater in the cities and large towns, where the high tension of life is felt by all sorts and conditions of men, by children and adults alike. An error is made by some parents in making comrades of their children in too literal a sense. There is a growing tendency to remove the barriers between childhood and age. This naturally results in the feeling that the children should enjoy the same pleasures and indulge in the same pastimes as their elders. Such recreation is of a character too stimulating for the sensitive nervous organism of the child. It cannot fail to cause harmful effects during childhood, and frequently produces a neurasthenic and nervous temperament in later life. When a child becomes a man he should, assuredly, put away childish things, but it is unkind to compel him to do so while he is still a child. This is the frequent fate, however, of only children.

"There is a large class of parents," says Artemus Ward, "who have an uncontrollable passion for taking their children where they will stand a chance of being frightened to death." The carelessness of many parents in permitting their children to see and hear things that will harrow up their

souls and freeze their young blood is truly marvelous. It is often due to carelessness, pure and simple, or to obtuseness and failure to appreciate the feelings of a nervous child. The study of animal life is to be encouraged, but to take an impressionable child to see hideous and grotesque animals or loathsome reptiles is the refinement of cruelty. The little one dreads them by day and dreams of them by night, until some new terror takes the place of the old. Even the Jungle Books are capable of doing harm to a nervous child. Forcing a frightened child into the surf may far more than counteract the good resulting from a visit to the seashore. These are but illustrations of many instances in which children are frightened unnecessarily. Even if the cause seems trivial, it is simply cruelty to force a child into places where it will certainly be terrified. It is not the way to make a child courageous or brave, but will almost infallibly have the opposite effect. The effects of such frights upon the nervous system are often most disastrous. Many an attack of feverishness and mild illness of obscure origin could be explained by this cause could the doctor always know the facts.

"The vast army of neurasthenics and hysterics which now inhabit our cities," says Doctor

Rachford, "is yearly being increased by subjecting the immature nervous systems of young children to the almost constant excitement, strain, and mental activity with which our social order has surrounded them." The whole period of infancy and childhood is one of preparation for the duties of adult life. It is the desire of every parent that his child mature with a vigorous body and mind. Many of the conditions of modern life, however, tend directly to frustrate these wishes. Too often the parents, instead of aiding their child to become the strongest possible man, do what will produce the opposite result. The seeds of "neurasthenia" are frequently planted years before the child is born, and he enters the world with an irritable nervous system. Stimulation begins at the outset when every opportunity is utilized to play with the baby. This is frequently done with so much vigour that the child is rendered tired and nervous, for children have nerves as well as adults. Many a delicate infant is made sleepless and irritable by excessive fondling and tossing about. Though it seems a hardship, it is frequently necessary to forbid all play and frolicking with an infant. Every child, in fact, is better without it; an infant does not need to be amused.

As the baby grows older and intelligence grad-

ually develops, the tendency to overstimulation becomes stronger. The more delicate the child, the greater the harm. The parents, impressed with the extraordinary mental capacity of their descendant, frequently do serious injury in their anxiety to develop the mental processes. Thus far it has been a question of entertaining the parents rather more than of amusing the child. A little later the question of actual amusement of the child arises, and the matter is often seriously overdone. People forget that the world is fresh and new to the child, and has not yet become old and stale. They forget that the child's capacity of thought and comprehension is extremely small. The young child is interested in the most simple and trivial things, and it is an unkindness to force complex and difficult amusements upon him. The amusement of young children is largely derived from toys and playthings. The character of their toys, therefore, is of importance even in the case of healthy children.

One of the most noticeable peculiarities of childhood is a tendency to become attached to certain things and cling to them most persistently. The young child loves certain nursery songs, and never tires of hearing the mother sing them over and over. He loves certain stories, and listens

with minute attention to their hundredth repetition. He becomes attached to certain toys, and persistently goes back to them in preference to new and handsomer ones, and clings to the old dilapidated doll in preference to the most gorgeous new one. All this is common knowledge to every observer of children.

An explanation, or a partial explanation, is not difficult to reach. A child's mental capacity is as yet undeveloped, and his comprehension is very small. He knows and appreciates the old familiar doll and its few clothes. The new one, with its closing eyes and jointed limbs, and its complex and elaborate dress, is beyond his small comprehension. It tires him as much to investigate it and unravel all its mysteries as it does the lawyer father to master an intricate case. So he returns to the old one, that he loves and comprehends without effort. If the child is content with simple toys, why force upon him those that he does not love so much? Why not follow the plain teaching of nature, and allow him to pass his early childhood in the most simple and contented manner possible? It is true that he can be educated out of these simple tastes, too often at the expense of his own contentment and the happiness of those about him. When he has once formed tastes for

less simple amusements, he cannot be forced back into the old ways of life. If he becomes accustomed to a multitude of toys and a mob of dolls, and daily expects something new, the time will come when his requirements cannot be filled. He has tried and become tired of every amusement adapted to his own age and of that far in advance of it, and he becomes a burden to all about him. The most contented and quiet children that the physician sees in his rounds are not those with the most playthings.

Mental development is gradual, and is not of sudden growth. The infant outgrows his rattle and ring, and the young child gradually grows beyond his simple toys. But there are then more elaborate playthings, and these in turn, as childhood advances, give place to books and games. Each period of childhood, youth, and age has its appropriate amusements. The child under judicious management passes from one stage to another, and need not lack for entertainment from the cradle to old age. It is doing him a wrong to force upon him amusements beyond his age, and to coerce him into pleasures which properly belong to later years.

There is certainly a growing tendency to engender in children a taste for amusements which are

too complex, which overburden the mental faculties, overstimulate the imagination, and overtax the physical powers. Happiness in this world results from contentment, and contentment cannot exist when desires and longings are not satisfied. Fortunate, then, is that child who has been reared with simple tastes, is content with simple amusements, and has not been satiated with all the pleasures of life before he has reached manhood. A youth with simple tastes, and with something yet to learn and to enjoy, is far more apt to develop into successful and contented manhood than he who has early been forced to feel that all is flat, stale, and unprofitable.

CHAPTER X

The Diet of Children

The feeding of young children is yearly becoming a problem of greater importance, for the number who require artificial feeding is constantly increasing. The ability of mothers to nurse their children is certainly diminishing. There is in some quarters an undoubted tendency to shun this paramount duty of motherhood, though in my own experience this statement has found little confirmation. Decreasing maternal nursing is largely the result of inability rather than disinclination. When it is not possible, the mother does wrong to blame herself. It is often the result of no fault upon her part, but rather of the times and conditions in which she lives. When it is possible for a mother to nurse her child it is her duty to do so. The infant has certain inalienable rights. He is entitled to the best food and the best care his parents can give him, and is defrauded if he does not get them. It goes without saying that the best food is that supplied by nature, the food

upon which so many generations have thrived. It should not be taken from an infant except for the most weighty reasons.

A potent means of retaining the natural food supply, and thereby preventing illness in the infant, is the mother's own care of herself and her diet. She should have a simple but generous diet, because the secreting of thirty or forty ounces of milk a day is equivalent to hard physical labour. It should be a varied diet, and should not consist in too large measure of one class of food. Meat, milk, eggs, and well-cooked cereals should all be included in rational amounts. While milk is admirably adapted to her special needs, and should be used freely, the mother should avoid an exclusively liquid and sloppy diet. She should know that her mental condition is of as much importance as her diet. Ungoverned nerves and fits of temper are more harmful to the child than any ordinary indiscretions in eating. She should avoid a life of excitement as far as possible. By far the most important rule of conduct, both for herself and the little one, is regularity. Regularity in feeding, and regularity in all the details of life, are so important that their neglect may make maternal nursing impossible where it might otherwise be perfectly easy. Irregularity, bad habits of nursing, and

uncontrolled nerves are among the principal preventable causes of the prevailing frequency of artificial feeding.

The subject of the artificial feeding of infants has grown in importance as its frequency has increased. So important, in fact, has it become, that it has received the attention and profound study of some of the best minds of the medical profession. Great improvements have been effected within the past ten years, and the results are already apparent. The modern saving of child life has been due in no small measure to more rational methods of feeding. While differences of opinion exist regarding some of the details, upon essential points there is great unanimity among those whose opinion is of most value. The first and most essential point upon which opinions do not differ is that the best artificial food is cow's milk. No other food will, in the end, be as well for the baby. It is quite true that there are certain objections to it, and certain difficulties in its use. It is not to be expected that any artificial food will be wholly free from drawbacks or as completely satisfactory as is the natural food. But those objections are far less serious in milk than in any other form of artificial food. Some of the prepared foods are easily digested by some children, but we

must not fix our attention upon the present so closely as to forget the future. We should consider the remote as well as the immediate effects of the diet. It should not be our object to tide over a few months, and keep a baby quiet at any hazard, but rather to lay the foundation for strong and vigorous childhood. We fail to accomplish this if we use a food lacking in any of its essential elements, though the child may for a few months appear to digest it readily. A very weak food is, of course, more readily digested than a more nourishing one, and this is the secret of the ready digestion of some of the artificial foods. They do not contain the requisite elements. For example, condensed milk is usually given in the strength of one to twelve. But in this proportion the food contains but one-eighth the amount of fat and one-third the amount of caseine found in normal breast milk. It contains so much sugar that the child becomes fat, and the rickets that always follow its prolonged use is covered up. Any material increase in the strength of the condensed milk mixture so increases the amount of sugar that the child becomes dyspeptic. Close observation of thousands and thousands of cases has taught those medical men whose lives are given to the study of children that any artificial food that has

not fresh milk as its basis is disappointing. There are apparent exceptions to this rule, but even in these exceptions examination reveals evidence of rickets, if not more serious diseases. It is unfortunate that many of the injurious effects of improper feeding are not immediately apparent. Temporary success often blinds parents to undesirable results which are clearly manifest only after weeks or months. Were these results immediately visible there would be much less injudicious feeding.

It seems rational to take the mother's milk as the standard by which to measure the artificial food, when such food must be used. The artificial food should contain the same constituents as the standard, and they should be present in about the same proportions. If we apply this method of measurement to the various artificial foods in the market, we find them sadly lacking. A few of these foods have in recent years been so changed that they simply become additions to modified milk. In these, however, the milk is rarely given in sufficient strength. The infant's natural food is an *animal* product, consisting of fat (cream), albuminous matter (caseine), a certain form of sugar (sugar of milk), and mineral salts. The various patent foods are composed largely of

vegetable products. They are one and all lacking in fat. Their albuminoid matter is of vegetable origin, not animal. It is not caseine. Each of these elements has its office to perform in the nutrition of the child, and cannot be materially reduced or changed in character without detrimental results. The fact that some of these foods approach the standard in chemical composition means little. The chemist only determines the amount of chemical elements present, not their properties or physical form. He can detect no difference between a diamond and a piece of hard coal. To him, they are simply pieces of carbon. The difference between these foods and mother's milk, although the chemist finds some of their elements similar, is just as great as between coal and the diamond. Vegetable oils and albuminoids are very different from animal fats and albuminoids, though their chemical analysis may be similar.

Cow's milk properly modified is the best food for an infant, because on that food he will develop into the sturdiest child. By modified milk is simply meant milk that is adapted to the individual child. Cow's milk is not the same in its proportions as mother's milk. It must be changed or modified, therefore, in the strength of certain of

its ingredients. There is, however, no one strength that is adapted to all children, not even those of the same age. Successful feeding consists in adapting the milk to the needs and digestive power of each child. No one formula, therefore, can be given, or no set of formulas. Beginning with a weak mixture, it should be slowly increased until it meets the requirements of the particular child. The four essentials necessary to successful feeding are: first, the use of pure, fresh cow's milk; second, adapting it to the digestive capacity of the child; third, scrupulous cleanliness in its preparation and all the details of handling; fourth, regularity of feeding.

A word of advice may be given on the selection of milk, particularly that to be used by infants and invalids. One of the drawbacks to its use is the fact that it may become contaminated, as may proprietary foods and condensed milk. As cities have increased in size, the question of their milk supply has become of grave importance. Next to the water supply, the milk supply is justly regarded as the most important question in the hygienic branch of municipal affairs. In no department of public hygiene has greater advancement been made than in this. The improvement in the milk supply has been one of the most potent

factors at work in the reduction of child mortality. At first, attention was chiefly directed to sterilizing or pasteurizing milk to kill the germs. This was a step in the right direction, but only a step. We have not yet reached a stage of perfection which renders it safe not to pasteurize most milk used by infants in hot weather. Another step has been taken, and the very rational course has been adopted, of attempting to keep the germs out of milk, another instance of the modern appreciation that prevention is better than cure. These efforts have been directed to the hygienic improvement of the dairies, the exclusion of diseased animals, and improvements in methods of transporting and delivering. Really clean dairies may now be found all over the country. Cleanliness in every detail in the management of the buildings, animals, and employees, with abundance of sunlight and fresh air, have resulted in the production of milk so clean that it will keep like sterilized milk. Bacteriology has shown that there is no decomposition, fermenting, or souring without germs. While it has not been possible, and probably never will be feasible, to absolutely exclude certain germs from milk, the number has been rendered so small that if the milk be kept at a low temperature it will remain wholesome for days. Milk from American

dairies, without pasteurizing or the addition of chemicals, was sent to Paris and sold on the grounds of the Exposition during the summer of 1900.

The importance of this subject of clean milk cannot be too strongly insisted upon. Clean and wholesome milk can be obtained in every large city at rates but little more, and in some cases the same, as those charged for unwholesome milk. Supply follows demand. If the people demand clean milk, they can have it. If they patronize only those dealers who supply it, every dealer will soon be forced in self-defense to produce it. The milk known in many places as "certified milk" is that produced under the supervision of a commission of medical men and scientific experts. This commission has no financial interest in the dairy, their only interest being that of public-spirited citizens endeavouring to improve the character of one of the most important staples of food. The veterinary, chemist, and bacteriologist are all responsible to this commission.

It is the belief of competent observers that no one hygienic measure has resulted so certainly in the reduction of mortality rate among children in New York City as the improvement in the milk supply. What is true in New York is equally true in other large cities. Even if the prepared foods

were desirable, they are too expensive for use by the poor. Until recently "grocery milk" was the food of a large part of the infant population of the tenement regions. Of the various efforts made to improve this food, the most effective has been the Straus system of milk depots. By this great philanthropy wholesome milk is supplied in the tenement regions at a price within reach of the poorest. It is given out in separate bottles, each being sufficient for a single feeding. During the first five years of the existence of this philanthropy more than 2,000,000 bottles of milk were distributed, as many as 7,000 having been given out in a single day. During the summer of 1902, 976,040 bottles were given out. Several dispensaries have adopted similar measures. The system has been educational as well as directly beneficial, and has taught the mothers as nothing else could do the great fact that the summer diseases of children are preventable, and that attention to the food is an absolute requirement to their avoidance. These facts, together with a marked improvement in the general milk supply of the city, are among the most potent factors in improving the conditions shown by the mortality records. They teach the lesson, which the well-to-do should learn, that wholesome food is the chief preventive

measure against the most prevalent diseases of early childhood.

The importance of starting the diet of the young infant right is not fully appreciated. The foundation of much of the malnutrition, indigestion, and marasmus seen in infants, is laid during the first few weeks of life. Indigestion, when once established, is very difficult to cure. Its effects often continue during the whole of the first year. An attack of indigestion must be regarded as a serious misfortune; the younger the child, the greater the misfortune. A single careless feeding may cause an acute indigestion which will be the starting point of a long series of disturbances. The error is quite too common of looking upon the body as a machine, any derangement of which can be set right by simply removing the cause. The human body is not a lifeless machine, but a combination of living tissues. Stopping the original cause of disturbance does not usually stop the symptoms. A child that has been improperly fed can rarely be set right at once by the administration of proper food. If the indigestion is due to bacterial action, or to a vegetable ferment, it will probably continue for a certain time under the most favourable feeding, because the germ or the ferment remains to act upon everything that

is introduced into the stomach. An intestinal catarrh, when once begun, is very slow and difficult of cure, and will prolong the indigestion.

When the digestive secretions are impaired or undergo any decided change, they do not at once recover themselves or adapt themselves to changed conditions, even if those conditions are perfection itself. The nervous system, notably that portion which presides over the digestive functions, readily acquires habits and peculiarities of action which continue after the causes which generated them have been removed. The debility and anemia which follow in the train of improper diet are felt by the digestive organs in common with the rest of the body, and impair their action long after the cause is removed. The younger the child, the less is its resisting power, and the more potent do these various factors become. There is no more difficult task than the remedying of an impaired digestion in a young infant. In no place is the old adage that prevention is better than cure more true than in medicine; in no place in medicine is it more true than in the management of early infancy.

No detail in the management of artificially fed children is too trivial to be considered. The neglect of some of these details will often more than counterbalance the greatest care in other directions. It is impossible in this place to con-

sider all these matters, it not being within the plan of this work. It has been the intention rather to point out the essential features whose observance has resulted in the saving of child life. The subject is worthy of a special volume, and several reliable books are available in which the various details of infant feeding and management are considered.* The great thought and study devoted to this subject during the past two decades are bearing fruit. The rate of death during the first year of life must always be excessive as compared with later years. There are certain conditions which can never be wholly overcome. It is the period in which the inexorable law of the survival of the fittest is most rigorous in its action. This law must continue to act, and certain of the unfit must succumb. A considerable part of the death rate in the past, however, has been made up of perfectly healthy children whose deaths have become unnecessary in the light of present knowledge. The saving of these valuable lives forms one of the brightest pages of modern medicine.

* Among the best of these books on the management of infancy are the following: "The Care and Feeding of Children," by L. Emmett Holt, M. D. (Appleton); "The Baby, His Care and Feeding," by Marianna Wheeler, Superintendent of the Babies' Hospital (Harpers). An excellent little book, "The Care of the Baby," by J. P. C. Griffith, M. D. (Saunders); "Talks with Young Mothers," by C. G. Kerley, M. D. (Putnam); "The Century Book for Mothers," by Yale and Pollak (Century Company).

CHAPTER XI

Faulty Nutrition of Children

In the present chapter certain conditions of faulty nutrition in children are considered. They are not only in themselves the cause of illness and death, but some of them are the active predisposing causes of other and more serious diseases. Although classified as nutritional disorders, it must be said that there are some who regard rickets and scurvy as infectious diseases, but this opinion lacks confirmation. Malnutrition, marasmus, rickets, scurvy, and anemia form a group of great importance.

Malnutrition of a more or less marked type is very common among infants and children. It varies in severity from slight anemia to extreme marasmus. It occasionally occurs in acute forms. This is most common in young and very feeble infants, but it may result from improper or inadequate diet at any age. More commonly it is slow and progressive. Malnutrition is a condition, rather than an actual disease. According to Holt,

in each hundred well-marked cases about twenty are due to inherited weakness of constitution, about twenty to improper or insanitary surroundings and improper methods of care, and about sixty to improper methods of feeding. While inheritance seems to be the only factor in some cases, it is a contributing factor in many others. The children of tuberculous, alcoholic, and very feeble parents are prone to malnutrition. The same is true when one or both parents are high strung and unstable in nervous temperament, the so-called nervous people. Not only are the children of erratic and nervous mothers prone to be delicate, but they are apt to receive injudicious care, with overindulgence in one direction and overseverity in another.

The second active cause of malnutrition is improper hygienic care and unsanitary surroundings. It is, therefore, common in tenement regions, and accounts for the high mortality of the children of those localities when attacked by acute disease. Similar causes, however, are sometimes active in well-to-do families. Children who are kept in close rooms, without proper exercise in the open air, are very prone to be delicate, and easily pass into a stage of malnutrition. Overcautious mothers frequently cause the very conditions they are striving to avoid.

The most potent cause of malnutrition is improper feeding. The child may receive inadequate nourishment and become anemic and thin simply from lack of food. In a far greater number of cases, however, the opposite error is made. Many more children are overfed than underfed. If a child receives more food than it can properly digest, but still a quantity short of causing acute indigestion, the symptoms to the ordinary observer are frequently those of insufficient feeding. The surplus food, instead of being properly digested, ferments, and causes restlessness and discomfort, and other symptoms which are attributed to hunger. Pernicious products are formed by such fermentation which are absorbed and cause loss of flesh. The same results may follow the giving of improper food. Much of the malnutrition in young infants results from errors in starting the diet. The digestive functions, being once deranged, are very slow to return to their normal condition, and the general nutrition suffers. Importance of starting the child's diet right is considered in the preceding chapter, and is again referred to only to enforce its importance.

An attack of acute illness is frequently the starting point of malnutrition. The depressed condition produced by the illness is felt by the digestive

organs in common with all the other organs of the body. The child is not able to digest sufficient food to replace the waste produced by the illness, and gradually falls into a state of impaired nutrition. This does not necessarily follow acute disease, but in feeble children and in those in whom predisposing causes are present, it is not an infrequent result. In older children it is one of the most common causes of impaired nutrition. The prolonged and wasting diseases are those which are most often followed by malnutrition, but occasionally short and acute illness may cause it. The diarrheal diseases are frequently followed by weeks and even months of physical depression, in which the feeding is a difficult and distressing task. A warning should be given to parents against the danger of assuming that in every case of impaired nutrition only the condition of simple malnutrition is present. It is the first symptom of several of the wasting diseases, and medical advice should be sought lest this error be made.

Many of these children of feeble digestion, the result either of inheritance or inherent weakness, are sources of great care and anxiety, for their feeding is always difficult. As soon as the strength of the food is increased to the point where the child

will gain adequately in weight, the digestion fails and the food must be reduced. So there is a constant struggle between insufficient nourishment upon the one hand and indigestion upon the other. In either case, more or less malnutrition is the result. The difficulties of the mother in such cases are usually not confined to her trials with the child. The advice of well-meaning friends is too often added to her other troubles. Healthy and vigorous children, whose digestion causes little trouble under any method of feeding, are held up to her as models. The advice to give the child more food is the one most commonly offered. The feebleness of digestion is attributed to her overcautiousness. She finally yields in an evil moment, and her troubles are increased by resulting indigestion and greater malnutrition. The officious friend who made the trouble will be none the less ready to offer other advice at her next visit. The advice-giving female never learns by experience. Her knowledge comes by intuition, and is extensive, because she knows so many things that are not so. The only safe course to pursue with these frail children is cautiousness and eternal vigilance. While it is true that feebleness of digestion continues through childhood in some children, and even through adult life, there are many others in

whom it diminishes or disappears during the second or third year. Many infants who have weak digestion and are difficult to feed during the first year develop into hardy children.

Marasmus is an extreme form of malnutrition, and is not common in well-to-do private practice. The occasional cases seen under such circumstances usually follow some long-continued and wasting disease, particularly prolonged attacks of summer diarrhea. Except when resulting from such conditions, it is caused chiefly by improper food and unsanitary surroundings. When this extreme condition of malnutrition is reached the outlook is very discouraging. It is particularly so under eight months. The causes are dietetic and hygienic, and must be prevented and cured by dietetic and hygienic measures.

Rickets, or rachitis, is a chronic disease of nutrition which is rapidly increasing in frequency in this country. Its most characteristic symptoms are due to softening of the bones and enlargement of the ends of the long bones. The disease, however, is not limited to the bones, but affects all the tissues of the body, particularly the muscles and some of the abdominal organs. While it is rarely

the direct cause of death, it is a condition of impaired nutrition which renders children particularly susceptible to acute diseases, and adds greatly to their danger when they occur. The rachitic child has not the stamina and ability to resist illness which the healthy child possesses. Rickets is most common between six months and three years, but its results are frequently apparent throughout childhood, and even into adult life.

The most characteristic symptoms of the early stages and of mild cases are sweating of the head and neck while the rest of the body remains dry; restlessness at night; constipation; delayed dentition; slight enlargement at the ends of the bones, particularly at the wrists and ankles; and what is known as the chest rosary. This latter consists of a row of little enlargements on each side of the chest at the ends of the bony portions of the ribs. Either of the first four of these symptoms may be present alone without indicating rickets. The combination of several of them is indicative of that condition. In the severer cases, deformities more or less marked are the result of the softened bones. Pigeon breast, knock-knee or bowlegs, and enlargement of the head, are the most common deformities. In the more extreme cases other deformities occur, but they are rare among the well-to-do.

In the milder cases the deformities improve somewhat as the child grows older and stronger. The more marked deformities can only be relieved by surgical operation.

Rickets has enormously increased in this country, having kept pace with the growth of the cities and the increase in foreign population. It is particularly common among the Italians and Negroes of the North. It is a disease which commonly follows the transplanting of a southern race into a colder climate. It is by no means limited to these people, however, but is found in every grade of the social scale, and is becoming more common in villages as well as large cities. It is so common in the cities of England that on the continent of Europe it is universally known as the English disease.

Rickets is essentially dietetic in its nature, but bad hygiene is an important element in its causation. It is a complex condition, and not due to a single cause. The idea, held for many years, that it was due to a lack of lime, is now known to be incorrect. Owing to the softness of the bones, this was a natural conclusion to have reached before pathology was as well understood as it is at present. The diet which will be most certainly followed by rickets is one that is deficient in fat.

If deficient in albuminoids, also, the certainty of its occurrence is increased. If to this is added an excess of sugar or starch, we have the diet par excellence for the production of rickets. Such a diet we have in condensed milk and certain of the proprietary foods. Their prolonged use is always followed by rickets. The excess of sugar in these foods produces fat. Hence, we often see in children thus fed striking examples of "fat rickets." The fat covers a multitude of rachitic sins from the eyes of the inexperienced. Such children often make very pretty pictures, of the kind adapted to the adorning of advertising pages. Rachitic children usually fulfil Kerley's description of them as an "ill-conditioned class of children, with their starved muscular and nervous systems and catarrhal tendencies, who fall an easy prey to broncho-pneumonia in the winter, to the gastro-intestinal diseases in the summer, and to the infectious diseases during the entire year." As regards really well-nourished children who have been reared exclusively on condensed milk, the same author aptly remarks that the doctor hears of more than he sees.

Of the unsanitary conditions tending to produce rickets, lack of sunlight and air is the most potent. It is the children in the tenement regions, and those

in the close and unventilated nurseries in the smart regions of large cities, who suffer most. If to these conditions is added injudicious diet, rickets is certain to follow. Those who might tolerate lesser errors in diet in good sanitary surroundings may become rachitic in unwholesome ones. Rickets is so rare in breast-fed babies as to be a curiosity.

The prevention of rickets is dietetic and hygienic, as indicated by a study of its causation. The first involves a knowledge of the modern science of infant feeding. The general outline of prevention is as follows: give a food which contains an adequate proportion of fat; exclude starchy foods from the diet of infants under six or eight months, and give them in moderation after that age; give the child an abundance of sunlight and air, and keep him in the best hygienic surroundings possible. In addition to this, clothing, bathing, and other details of hygienic care should not be neglected. It should be understood, however, that rickets may develop in the best of surroundings if the diet is faulty. A warning may be given against going to the other extreme in the diet and giving more fat than the child can digest. This will produce troubles of its own. The proper course is not toward either extreme. When it is possible, city children, who are the most liable to suffer from

rickets, should be sent into the country during the warm weather. Sea air is particularly beneficial when there is a rachitic tendency. Rachitic children must be managed with particular caution, for they are readily disturbed by causes that a normal child would not feel. Great caution must be observed in making sudden and extreme changes in diet and clothing.

An important agent in the prevention of rickets, as well as in treatment, is cod-liver oil. It supplies fat in a form which seems particularly valuable to the children who show this tendency. It is a wise plan to give it to delicate children in small doses twice or perhaps three times a day for one or two weeks in each month during the cold weather. In such cases it is to be regarded as a food rather than a medicine.

More space has been given to this subject than to many diseases with a higher death rate, for the reason that few other conditions so predispose to illness as does this. The doctor is apt to find that those children who suffer from one illness after another, and are said to catch everything that comes along, are either rachitic or have been so in their early childhood. The prevention of rickets means the prevention of many other ills, and the saving of a child from many dangers.

Scurvy.—When the statement was made, about ten years ago, that scurvy was becoming common among infants, it was received with incredulity by medical men. The unfortunate truth, however, soon became too apparent to be ignored. Eight years ago I found thirty-six authentic cases reported in American medical literature. Many times this number had undoubtedly occurred and had not been reported. Four years ago a committee of the American Pediatric Society collected 379 cases in which full and satisfactory histories could be obtained. They occurred in the practice of 138 physicians. When such a number of cases have been reported in full, it is evident that the disease is not a rarity or a curiosity.

A peculiar feature of the disease is the fact that it is rarely found in the tenement regions or among the poor, but occurs in the homes of the wealthy and among the children who are cared for with the utmost solicitude. Whether it occurs in infants or adults, it is due to a lack of fresh food. It was common years ago among sailors, arctic explorers, and soldiers, when salt food was largely used, and modern methods of food preservation were unknown. Since the nature of the food has changed, and lime juice and lemons are taken to sea, the disease has disappeared. It has again

appeared, because the same principle of diet has again been brought into vogue. Condensed milk, and proprietary foods designed to be used without the addition of fresh milk, came largely into use in the feeding of children. The fresh element of food was lacking, and the children became scorbutic. Proprietary foods are too expensive for use by the poor. Their children, therefore, escape one evil. In families where there are several children to be looked after by a mother who has many other cares, the diet is not rigidly watched. The neglected child who eats everything at the table may become rachitic or marasmic, but he obtains enough fresh food to keep him from scurvy. Even fresh milk diluted to a very weak mixture is not sufficient for protection. The committee report already referred to places the use of the proprietary foods and condensed milk as the first cause of scurvy, in the point of numbers they produce. The same was true of those cases which I first reported.

Scurvy is a very fatal disease when not recognized in time and properly treated. Of the 397 cases referred to, 29 died. It is easily mistaken for rheumatism, rickets, acute disease of the bones, and paralysis. The prominent symptoms are painful swelling of the legs just above the knee,

and occasional swelling of the arms, spongy and bleeding gums, and frequently hemorrhages under the skin or from cavities of the body. The swellings are intensely painful, and the child screams at the slightest touch. Anemia and malnutrition are usually present, and there is frequently a peculiar form of paralysis due to the intensity of the pain on motion. This false paralysis disappears as soon as the other symptoms subside. The disease is most common about the end of the first year, but may occur at any age if an absolutely strict diet of cooked food be given. I saw several cases in the idiot asylum due to the use of gruel which some of the patients insisted upon taking to the exclusion of all other diet. Prevention consists solely in giving a rational food whose basis, for infants, is fresh cow's milk. Treatment is simple, but the results are very brilliant. Medicine is absolutely useless. The disease is rapidly cured by the use of fresh milk in strength adapted to the child's digestion, with the addition of small amounts of orange juice.

Scrofula is a term no longer used by medical men, because the diseases to which it was formerly applied are now known to be tubercular in their nature. A special name is not required, therefore.

The conditions long known as scrofulous are simply localized tuberculosis. The most common of these is tuberculous adenitis, or inflammation of the lymphatic glands, particularly those of the neck. The tubercle bacilli enter through the tonsils or the mucous membrane of the throat and nose, and are taken by the lymphatic vessels to the lymphatic glands. Here they cause a chronic type of inflammation which often results in suppuration, which is also very chronic in character. If neglected, the pus finally discharges spontaneously, leaving ragged, chronic ulcers, the so-called scrofula sores. When these have finally healed, large irregular scars are left behind and are permanent. The whole duration of the disease is usually about three and a half years, but may be much longer. The discharge from these sores is often swarming with tubercle bacilli, and is as dangerous as is the expectoration of consumptives, and should be disposed of with much care.

When the glands have become enlarged they may frequently be reduced by active constitutional treatment or change of climate. If they persist, or grow larger after several months, removal by surgical methods is advisable. A small, clean scar is thus left instead of an unsightly one; the disease is shortened, and the long and exhausting suppura-

tion is avoided; the danger of general infection of the patient is removed, as well as danger to others.

The term "scrofulous," or "strumous tendency," is still frequently used. A predisposition to some particular form of disease is seen in many people. This the doctors call a diathesis. The most common diatheses are the rheumatic, the uric acid, the gouty, and the strumous. It should be understood that there is no such disease as scrofula, but only a tendency or diathesis which predisposes to certain disorders, and modifies every disease from which the individual may suffer. Much was said by the older writers upon the physiognomy of scrofulous children, two types being commonly described: the one fair and delicate, with thin skin and soft hair; the other dark and gross, with thick, muddy skin and coarse hair. While there is some basis of truth for this classification, the minute details and long-drawn-out descriptions were mostly evolved from the imagination. There was a time when almost every disease of childhood was attributed to scrofula, particularly rickets and the various forms of malnutrition. As recovery from many of these diseases is common, it is not strange that the "King's Evil" often improved after the child was touched by the monarch. King Charles II. touched, in twenty years, 92,107

persons. Doctor Johnson, when a child, was touched by Queen Anne, but, according to the description given by Boswell, he showed a strong scrofulous tendency to the end of his days.

Two conditions are particularly common in children of the scrofulous tendency—enlargement of the lymphatic glands, which has already been referred to, and a tendency to catarrh of the mucous membranes. Certain diseases of the joints and skin are also rather common to children showing this tendency. The tendency to catarrh renders a child particularly liable to nasal catarrh, adenoid growths, enlarged tonsils, discharges from the ears, inflamed eyes, and bronchial colds. Scratches and injuries suppurate easily, and sores heal slowly. A vaccination on the arm of a child of this tendency is prone to suppurate, and run a longer course than the normal, but it does not produce "scrofula." The scrofulous tendency was there, and the irregular course of the vaccination was but one of its manifestations. Such children lack the power to resist bacteria which the normal organism possesses. Hence their wounds become infected more easily than those of average children do, and they contract contagious diseases more readily. The most serious feature of the

strenuous diathesis is the strong tendency it engenders to tuberculosis. Not only is localized tuberculosis of the lymph glands very common, but general infection is much more liable to occur than it is in other children.

The strumous diathesis is usually congenital, and often hereditary. It may, however, be acquired. The conditions which produce it are life in ill-ventilated and overcrowded habitations, absence of sunlight, unsuitable food and clothing—in fact, the conditions which are associated with poverty and squalor. It has been well called *la scrofula a miseria*. The prevention of hereditary scrofulous tendency consists in the proper management of the ancestors for two or three generations back, in precluding the marriage of two persons who each show the tendency, and in preventing consanguineous marriages. The tendency, when manifest in a child, may be largely and often entirely overcome by suitable and nourishing food, life in the open air, judicious clothing, and the observance of the numerous details which constitute hygienic living. Among the foods especially useful in such cases is cod-liver oil, which may usually be given to great advantage at intervals during the cooler portions of the year. It is fortunate if such a child can be under the

observation of a judicious physician, by whom he may be seen at intervals of a few months during childhood. He may thus be saved from many pitfalls, and the tendency to illness may be largely eradicated.

There are other diseases of nutrition, and special forms of anemia, but the conditions described in this chapter are the most frequent forms of perverted nutrition in early life, and are the ones which are the most potent as predisposing causes of the various illnesses which occur among children. Their prevention will do much to prevent disease and death during the period of childhood and early youth. The infectious disorders of infants and children are considered in the chapter on the special infectious diseases.

CHAPTER XII

Heredity

Heredity is a subject upon which many erroneous views are held. Many things are attributed to it for which it is not in the slightest degree responsible. It is a difficult subject to make clear to the average reader, for it involves complex questions of biology. It is, moreover, concerned with certain matters difficult to discuss in a popular treatise. No attempt will be made, therefore, in the present chapter, to present the subject in a systematic or exhaustive manner. Certain points only will be touched upon which are of popular interest, and concerning which there is a misunderstanding.

The first point upon which error is made is the confusing the two fundamental terms, hereditary and congenital. This error is due to the common mistake of regarding the individual as beginning his existence at the moment of birth, and not until then. Everything occurring before that moment is popularly grouped as hereditary. What a person

is born with is congenital; it may be hereditary or it may not. Birth is simply a date at which a change occurs in the mode of existence, not in the individual. "That alone is inherited which is the property of the individual at the moment he becomes an individual, which is the property of the germ plasms from which he originates." An accident before birth may cause a deformity, but it is not hereditary; it is congenital. A disease may be transmitted to the child before birth. It comes to it, however, like the accident, and is also congenital, not hereditary.

It must be said, however, that to the average individual this distinction seems unnecessary. If he has been born with some defect, it makes little difference to him whether it be called hereditary or congenital. He may have the satisfaction of knowing, however, that if it is not hereditary he is not in as much danger of involving his descendants in the same misfortune. It is still as true as it has ever been that the iniquities of the fathers are often visited upon the children and the children's children, not always as the same disease, but as a defective body or brain or an enfeebled constitution. "The fathers have eaten sour grapes, and the children's teeth are set on edge." One cannot sin against his own body or soul without

the danger that his children will suffer for it in the future.

Another point much misunderstood, even by medical men, is the fact that conditions acquired by the parents are not transmitted by heredity. The law of Galton, enunciated more than twenty-five years ago, has never been disproved: "Acquired modifications are rarely, if at all, inherited in the correct sense of the term." For example, polydactylism, or redundance of the fingers, is very hereditary, and is seen in families generation after generation; but the child of a father who has had his arm amputated is not born with one arm. The same is true of diseases. There are several that are congenital, probably none that are hereditary.

Another term which requires definition is degeneracy. It is often confused with heredity. Degeneracy is at present a popular fad both within and without the medical profession, and has been made to cover a multitude of conditions to which it cannot with any scientific propriety be applied. The jaundiced mind of Nordau sees only a jaundiced and degenerate world, and has attempted to throw the stigma of degeneracy over many conditions due to totally different causes. A brief review of the meaning of the two terms may,

therefore, be profitable. Heredity is "the inheritance of certain qualities or tendencies." It has still further been defined as "the tendency manifested by an organism to develop in the likeness of its progenitors." Degeneracy, on the other hand, is "the absence or loss of that degree of development or energy seen in the ancestry of the organism." Maudsley defines degeneration as follows: "It is now used exclusively to denote a change from a higher to a lower kind; it is a process of dissolution, the opposite of the process of involution."

It is clear, therefore, that heredity and degeneracy are two quite different conditions. The one is a tendency to develop the type of the ancestor, the other is a tendency to develop a lower type than that of the ancestor. Heredity is always due to inheritance; degeneracy may be due to inheritance or acquisition.

There is an important practical deduction to be drawn from this. Hereditary tendencies, even if they are not good, may be modified or improved by training and judicious management. Mental capacity may be encouraged and drawn out by education. A tendency to disease may be eradicated, or the disease may be cured, but there is no cure for that which is not disease,

but defect. Much thought has been given in recent years to the training of defective and backward children. Much may be accomplished by skilled and judicious training in the milder cases, and something in the graver ones. What capacity there is may be developed and drawn out, often in a surprising manner, but if there is actual deficiency the limit must be reached sooner or later. There is no human skill that can furnish deficient brain or body tissue. The old adage is here particularly true: "What the cradle rocks the spade will cover." But beware of hasty judgments in children. Some are precocious, and ripen early; others mature late, like winter fruit. Some of these backward and undemonstrative children are simply slow in development, but finally reach a high degree of maturity and have great staying powers. Do not jump to conclusions, but give every child a fair chance.

There are certain factors of heredity to which I wish to call particular attention. They are four in number:

1. There are elements of good heredity which frequently neutralize those of bad heredity.

There seems to be a strong tendency to forget that there is such a thing as good heredity. It is an erroneous but very common belief that certain

diseases are always repeated unmitigated from generation to generation. The mere expression, "hereditary tendency," seems to suggest to most minds tuberculosis, scrofula, rheumatism, or gout. We now recognize the fact that diseases are not directly inherited, but rather some tissue peculiarity which renders the individual peculiarity susceptible to those diseases. Such peculiarity produces a tendency to a disease, rather than the disease itself. If the individual inherits from one parent a sound tissue condition, one inimical to the development of a given disease, we may never see in the child any tendency manifested toward that disease. This principle undoubtedly explains why some children escape a disease whose appearance we have much reason to expect. It is quite true that it is easier to be certain of the actual presence of a disease in a person, than to know that he really has no tendency to it. Nevertheless, the complete absence of a disease in a family or an individual is an element of decided importance. Absence of a disease in one branch of a family is of particular importance, if it is evident that the child decidedly resembles that branch of the family, rather than the other, in which the disease may have existed. The resemblance to one parent, and to the family of that

parent, is sometimes very striking. It is usually not alone confined to features and physical appearance, but is also seen in temperament and behaviour under disease influences.

2. A tendency, even if slight, if it exists in both parents, may appear in a child in an exaggerated degree.

This principle accounts for the strong tendencies which sometimes appear in children when the family history shows but slight tendency in that direction on either side. A father and mother, for example, who are moderately rheumatic, may have a child who is extremely rheumatic. Had one of these parents been a member of a non-rheumatic family, the child might have escaped, perhaps with a less rheumatic tendency than that exhibited by the other parent. When a tendency to a given disease or a given temperament is strongly marked in both parents, the child rarely escapes. The inherited tendency in such conditions is frequently so great as to cause serious physical or mental aberration. One of the causes of degeneracy is this combined inheritance of grave pathological physical or mental conditions.

3. Heredity is strongly modified by a powerful tendency on the part of nature to preserve the type of each family and species.

Permanence of type is one of the most unchangeable laws of nature. Abnormalities and exceptions may occur, but the tendency is not to their repetition, but rather to reversion to the original type. Abnormal cases, while they evince sometimes a strong tendency to reproduce themselves, are continuously under the influence of this law. The child of a talented man is frequently as talented as his parent, but the child of a great genius is rarely a genius. The genius is an anomaly, and his child tends to revert to the average type. Genius does not appear in the same family generation after generation, but talent shows a strong tendency to concentrate itself in families. The number of talented families is undoubtedly increasing.

As a further example, take the question of bodily height, upon which accurate observation is easy. It has been demonstrated by scientific observation, that the children of tall parents are generally shorter than the parents, and the children of short parents are generally taller. Professor Wilson affirms that there is a strong tendency to keep the average height of five feet eight and one-half inches. These are examples of a law which has a very wide application. Nature, while she permits infinite diversity and encourages individuality,

even to the extent of tolerating many exceptions and anomalies, is strongly adverse to their repetition, and permits no long-continued wandering from the limits of the type.

A study of species shows that the whole tendency of evolution has been upward. "No type of organization," says Winchell, "having once entered the portal of a higher life, has been permitted to retreat." The genus homo is no exception to this rule. It has steadily advanced through the ages, each race ever keeping within the limits of its own type. "No new race," says Topinard, "having characters other than those of the mixed races, has been created within our knowledge." Evolution has ever been from a lower to a higher type. There is no evidence to show that this great law of nature has been reversed in our own generation. It is true that we see many examples of individual degeneracy, but it has not been demonstrated that they are more common now than in the past. What is true in the larger field of races is also true in the more limited one of nationality, tribe, and family. Nature is still very tenacious of the type, and preserves it unchanged through passing generations. The experience of the practising physician confirms this. While he sees numerous examples of inher-

ited taint and congenital defects, he also sees defects in the parents obliterated in the children. He sees neuroses in one generation appearing in milder form in the next, or disappearing altogether. He sees children who are stronger and more robust than either parent.

It is a mistaken conception that hereditary tendency is only toward the bad and away from the good. There are two well-defined tendencies in heredity—the one toward the normal, the other toward the abnormal. These tendencies are constantly at strife. Had the stronger tendency not been to revert to the normal type, the course of the race would not have been toward advancement, but to steady and continuous degeneration, and to final extinction.

4. Hereditary influences are not all apparent in infancy, or at any other particular age, but certain tendencies appear at certain periods of life, and frequently disappear when that period is passed.

Parents frequently express surprise that their infants exhibit tendencies or show weak points which they themselves do not possess. The grandmother sometimes explains the matter by saying that one of the infant's parents showed the same traits *when a baby*. On the other hand, an infant often fails to show conditions which might be

expected if one did not study the hereditary tendency of the family. Such conditions may not develop until late in life.

Every individual must pass through certain periods of development before full maturity of mind and body is reached. This requires about twenty-five years. No argument is necessary to prove that this developmental period is a most important one in the life of an individual. While this is true of all the organs and systems of the body, it is particularly so of the nervous system. Many organs act as perfectly in infancy as in adult life, but the brain requires years to develop its functional activity. A child comes into the world with one-third the volume of his brain; he acquires the second third before twelve months are passed, and the rest between that time and the twenty-first year. Herein lies the great difference between the nervous system and every other system of the body. Its physical development more than keeps pace with that of the body at large, but its functional development is exceedingly slow, requiring years for its completion.

The higher we go in the scale of civilization, the more prolonged is the period of functional growth. It is easy to understand, therefore, why so many different nervous diseases develop at different

periods, and why so many defects appear for the first time at varying intervals during a space of twenty or twenty-five years. The brain has certain well-defined stages and periods of development, and various forms of nerve disorders appear as these stages are reached.

A study of the developmental periods of life elucidates many obscure phases of disease during childhood and youth. Certain defects are characteristic of certain periods and invariably develop within certain age limits. Doctor Clouston, of Edinburgh, has described these periods with great clearness. The first is the embryonic. Inability to complete the various processes through which the organs attain their growth must result in grave and radical defects, both physical and mental. These defects are seen when the child is born. At birth a grave crisis occurs in the life of the individual. It is then to be determined whether the development of the various organs is sufficiently perfect to maintain independent life. In many cases the test is too severe, and the infant dies from innate defects, and inability to adapt itself to the new conditions.

The next period that brings out the defects of bad heredity is that of rapid brain growth, which extends from birth to about seven years. This is

the period of special sense education, motor coördination, and speech. The abnormal conditions incident to this stage are convulsions, night terrors, infantile paralysis, stammering, strabismus, hydrocephalus, liability to sudden rises of temperature, and numerous other abnormalities. Most of these are associated more or less closely with the great brain growth and the development of certain brain functions, such as speech and equilibrium.

The next period extends from seven to thirteen years, when muscular motion becomes fully coördinated with emotion, as seen in facial expression. The diseases especially incident to this period are chorea (Saint Vitus's dance), epilepsy, somnambulism, migraine, and certain eye defects, especially near-sightedness.

The last period extends from thirteen to twenty-five, and is marked by the emotional and moral development that centre around this time of life. We may now have hysteria, epilepsy, eccentricity, and certain forms of emotional wilfulness and moral perversion. While the boundary lines of these various periods are neither exact nor well defined, much may be learned regarding the various diseased conditions of early life by due consideration of such a classification.

Heredity is a very potent predisposing cause in

nearly all the nervous disorders common to the developmental period of life. In a few instances, it is the only cause, neurotic conditions being inevitable during growth and development. In most cases, however, heredity can only be considered a predisposing cause, some exciting cause being necessary to waken the disease into activity. The possibilities of prevention are many, and it is here that preventive medicine may find some of its greatest opportunities. In spite of all that can be done, however, many must suffer. Their fate was sealed before birth, and no skill can overcome the defects. Nevertheless, something can be done for all, and some can be saved entirely.

No better advice has ever been formulated than that given by Doctor Clouston: "Build up the bone and fat and muscle, especially the fat, during the periods of growth and development. Make fresh air the breath of life to the young. Develop lower centres, rather than higher ones. Do not give too much nitrogenous food during growth and adolescence, as being a special stimulant to the higher brain and to the too early development and dominance of the reproductive functions. Avoid alcohol and the nervine stimulants absolutely if possible. Do not cultivate, but rather restrain the imaginative and artistic faculties and

sensitiveness, and the idealisms generally, in the cases where such tend to appear too early and too keenly. They will be rooted on a better brain-and-body basis if they come later. Cultivate and insist on orderliness and method in all things. The weakly neurotics are always disorderly, unbusinesslike, and unsystematic. Fatness, self-control, and orderliness are the three most important qualities for them to aim at."

It is evident that, while heredity is a positive and important factor in the making up of our characters, it is not what many suppose it to be. Knowledge and culture are not inherited, but depend upon education, influence, and environment. Mental capacity for culture is transmitted. Heredity has, in fact, been defined as "original capacity and original limitations." One man inherits a capacity to do great things, but it must be nurtured and developed or the great things will never be done. He may inherit a capacity for learning, but he must study and be instructed or he will not become learned. Another has had hereditary limitations put upon him which ever restrict him within certain channels and forbid him to go beyond certain boundaries. We all have our limitations. In some they are very narrow, in others very broad. As in mental

qualities, so it is in physical. Tuberculosis, insanity, gout, and other diseases are not inherited any more than are education and culture, but rather certain hereditary tendencies or tissue conditions which may be readily evoked if exciting causes are brought to bear.

These various predispositions may be transmitted, but there is no certainty that they will be in any individual case. The parent is in a certain sense a trustee, and transmits to his child largely what he has received from his ancestors. One parent may thus increase or limit the inheritance that would come from the other. Heredity is, then, the transmission of certain *capacities, predispositions, and tendencies*, upon which are placed certain original limitations.

CHAPTER XIII

Regimen of Adult Life

"Nothing conduces more to Health and Long Life, than Abstenance and plain Food, with due Labour. When exercise is wanting (as in studious persons) there is greater need of Abstenance, and tender Persons ought to use as much Abstenance as they possibly can. As to the amount of Food, Nature requires no Mathematical Exactness. A plain rule for judging of the Quantity is, not to eat so much as indisposes for business." Thus wrote wise old George Cheyne, in that remarkable "Essay on Health and Long Life, printed at the Golden Ball over against the Royal Exchange in Cornhill, 1725."

It is difficult to write wisely and well on diet. It is still more difficult to write in a manner that will not evoke criticism from some quarter. Upon few other subjects is there greater diversity of opinion or tendency to extreme and radical views. Nothwithstanding the fact that digestion consists of a series of complex chemical processes, people with no chemical knowledge whatever are

often heard to enunciate the most positive but extraordinary views upon the subject. In fact, extreme and peculiar views seem prone to follow a study of dietetics by the average individual. He is apt to adopt some peculiar school or doctrine, and to become more extreme the longer his mind dwells upon the subject. "An exclusive and sectarian spirit always creeps in," says Sir Henry Thompson, "wherever an 'ism' leads the way, which sooner or later brings in its train assertions barely supported by fact, the equivocal use of terms, evasion—in short, untruthfulness, unintended and unperceived by the well-meaning people who have adopted the 'ism.' At last they suffer unconsciously from obscurity of vision, and are in danger of becoming blind partizans."

Surprise is sometimes expressed that dietetics receives so little attention from educated people. One reason, no doubt, is the fact that so much that is written upon the subject is impractical and foolish. Looking at random into a recent number of one of the leading journals on hygiene, we find that the first article gives numerous dietetic rules, some of them admirable in the extreme. But at the outset we find the following: "Never eat when in a hurry. Take no vigorous exercise, either mental or physical, for half an hour before a

meal, and for at least one hour afterward." This is good advice for those who have leisure, but how about the ninety and nine in every hundred toilers of this workaday world—the business men, lawyers, doctors, housewives, mothers of families, clerks, shop-girls, and manual labourers. They must eat when they can, and must then go to work. Nuts, this article says, are better than meat. The nut fad now in vogue is very foolish. Still further it says, "when a dessert is served, a good plan is to have it at the commencement of the meal; there is less danger of overeating." This is true to an extreme degree. Dessert at the outset could be relied upon to put a damper on any appetite. It is such advice as this that gives many people the feeling that dietetics is a system cunningly devised for cranks, and a few individuals of the leisure class.

To allay any apprehension, therefore, let it be fully understood at once that no "system" of dietetics is to be proposed here, and no food or class of foods is to be advocated as capable of relieving all the ills of human flesh. On the contrary, let us start with the fundamental proposition that it is wise to utilize as many as we possibly can of the good things given to men by a bountiful Providence. We may not want them

all ourselves. We may not wish to eat whale blubber or sharks' fins, but let us leave them to the Eskimo and the Chinaman.

It is not desirable to confine ourselves to a single article of diet, or even to the same classes of foods. There is scarcely a food in general use that has not some good point, and few that may not be used by some individuals. In variety there is health, and a table that offers a variety from day to day is the one at which the best appetites and digestion will be found. The appetite is prone to fail when the same things appear day after day, though the variety be large. This is often seen at the hotel table, where the menu is usually larger than that of the home table. At first the variety seems large, and the appetite is stimulated, but the sameness becomes wearisome after a little time, and the appetite is apt to diminish. A few well-selected dishes, with changes from day to day, is better for the digestion, as well as for the appetite, than a throng of articles appearing repeatedly. If the diet be too much restricted, the stomach adapts itself to its limited work and loses the power to digest other food well. Man was undoubtedly designed by nature as an omnivorous animal, and he should have a mixed and varied diet.

For an understanding of the subject of diet a few

words are necessary upon the chemistry of foods, which are mixtures of various animal, vegetable, and mineral principles. The chief mineral principles are water and common salt. The animal and vegetable principles are three in number—albuminoids, fats, and carbohydrates. Albuminoids are the nitrogen foods, the most important of which are albumin and fibrin. They form an important part of animal food and occur also in certain vegetables. The fats are derived from both the animal and vegetable kingdoms. The carbohydrates include the sugars and starches, which are closely related. It was formerly the teaching that albuminoids are devoted exclusively to the building up of tissue and muscle, and the other two elements to the production of heat and force. While this is largely true, their line of action is not closely marked. Properly constituted food should contain a due proportion of each of these elements. As this condition exists in no single food, a mixed diet is necessary. No one food, even though it contains all these elements, has them in the proper proportion for the adult. Milk, which is most nearly a perfect food, is proportioned to the needs of the infant, not the adult. In vegetable foods, as a rule, the carbohydrates predominate; in animal foods, the fats and albuminoids.

Most albuminoids of animal origin are digested more readily and more completely than are those of vegetable origin. Animal fats are digested more readily than are vegetable fats, chiefly because of the cellulose coverings of the latter. The large amount of starch contained in many vegetable foods tends to produce in the stomach an acid fermentation. Uncooked starch is indigestible because the starch grains are surrounded by a tough capsule which the digestive fluids cannot penetrate. This capsule is broken by heat. Baked, or so-called roasted foods, which are subjected to a high degree of heat in the oven, are usually more digestible than boiled food, which has been raised only to the temperature of boiling water.

Animal food has a distinctly stimulating property, owing to crystalline bodies which are contained in the muscle serum. This property may be in some cases advantageous, in others detrimental. Properly selected vegetable food certainly contains all the primary food principles. The fact that certain individuals live in health without animal food simply proves that vegetarianism can be tolerated. It does not prove that it is best. There are, however, very few strict vegetarians. Most of those calling themselves by that name simply

eliminate meat from their diet. They eat milk, eggs, butter, cream, and even cheese—concentrated forms of animal food. Some do not even eliminate fish, shell fish, and animal jellies. This is mentioned not to criticize the use of these foods, but rather to protest against the adoption of the word vegetarian by those who eat every day large quantities of animal food. If most of the systems of diet alleged to be vegetarian are really such, then the infant at the breast is also a vegetarian. The person who eliminates meat, fish, poultry, eggs, cheese, milk, butter, and all animal food from his diet, may call himself a vegetarian. If he adopts that title without doing so, he is sailing under false colours.

The physiology of digestion is quite complicated, and difficult to explain in a popular manner. It begins, or should begin, in the mouth, where the starch begins to be changed by the saliva into sugar. Starch is not used as such by the body, but is converted into one form of sugar, of which there are several. Sugar is soluble, and difficult of preservation. Starch is insoluble, and can be preserved indefinitely. Hence, by a wise provision of nature, most plants change their sugar into starch and then store it up. By another wise provision man has been given the appliances for

changing the starch back into soluble sugar for his own use. As these appliances are quite complex, and not in working order until the latter half of the first year, the baby is given a liberal supply of sugar, not starch, in the form of milk sugar, which is easily absorbed. We see here another wise provision. If the baby is fed upon a modern improved food with unchanged starch in it, the only thing he can do is to let it ferment in his stomach and cause colic, because he cannot digest it.

In the stomach the albuminoid elements (the lean meat and white of eggs) are digested. Here the food is broken up because the fibrous structures which bind it together are disintegrated: another wise provision. In fact, as one progresses in the study of anatomy, physiology, and chemistry, and sees how they are interwoven to form mechanisms of marvelous perfection, he becomes impressed with the number of wise provisions he meets at every step. This breaking up of the connective tissues liberates the fats and starches and renders their digestion possible farther on in the digestive tract.

From the stomach an excess of fluid is absorbed, together with certain digested matters, and is taken by the portal vein to the liver. Alcohol is

thus absorbed. Hence, the unwisdom of drinking it before breakfast or upon an empty stomach. It is taken undiluted direct to the liver, where it expends its whole deleterious force upon that organ. Upon leaving the stomach, the food enters the duodenum, or upper portion of the small bowel. Here the starch, whose digestion was slightly begun by the saliva, is fully digested by being converted into sugar. The fat is broken up into minute particles and converted into an emulsion, in which form it is readily absorbed.

The digested portions of the food, being absorbed, must be acted upon by the liver and other glands, which are known as the organs of assimilation. The liver is in close proximity to the stomach and duodenum, and is closely associated with them in the work of digestion and assimilation. Disorders of one, unless very transient, are usually accompanied by disorders of the others. "Indigestion" is rarely a simple condition limited completely to one of the digestive organs. Sometimes in chronic cases the symptoms due to one will predominate, and at other times those due to another. Now it may be the stomach which causes the most trouble; another time bowel indigestion may predominate; at another time the liver may be the most prominent offender. The liver, however, is charged

with many sins it never commits. To the question, "Is life worth living?" the answer has been given, "It all depends on the liver." It is a good pun, but not very good science.

Let no one think that long years of dietetic sinning can be atoned for by a few weeks of correct living. As explained in another chapter, the body is not an inanimate machine, in which perverted action is always corrected when the cause is removed. The persistent eating of improper food and too much food causes fermentation, and the production of gases and acid substances. These in turn irritate the digestive organs and cause their secreting glands to act in an abnormal manner. Catarrhal conditions soon follow. This in its turn diminishes the digestive power and causes oppression, distension, or actual pain, and so the "vicious circle" is completed. Indigestion causes inflammation and perverted action; inflammation and perverted action cause indigestion. Finally, the stomach and bowels, through persistent distension, lose their muscular tone, and become dilated and flabby; their mucous membranes are inflamed and sore; their secreting power is diminished. The strength fails, and the patient becomes thin, irritable in temper, and despondent—in fact, a chronic dyspeptic.

Such organic conditions cannot be cured by a few weeks of rational diet. The sore organs will grumble at the most perfect diet that can be devised, and in many cases the stomach will "gnaw upon itself," and ache when empty. In many instances the adoption of a proper diet, if persisted in, despite discouragements which will constantly come, will result in final cure. The cure may usually be aided by judicious treatment, a change of scene, relief from work and care, and tonics. In the more severe and chronic cases the organic changes are so pronounced that change of diet alone is not adequate. Special measures are necessary, and tonic treatment in the broadest sense is required.

Improper diet is not the only cause of dyspepsia. Prolonged worry and anxiety, overwork, with hurried and irregular meals, or malnutrition resulting from disease, may cause it. The mother of a large family with slender means, who must all the time overdo her strength, eat hurriedly, and bear the multitudinous worries from which she can never escape, may become dyspeptic on a well-selected diet. Compression of the stomach is a frequent source of dyspepsia. The literary man, the bookkeeper, and the business man who allows himself to sit at his desk in a fallen-together atti-

tude, may become dyspeptic from that cause alone. The same is true of seamstresses and all workers who are obliged to lean forward at their work. While the diet in these various individuals usually requires correction, no change in the diet alone will effect a cure. Unless a better attitude is assumed, and the pressure is taken from the stomach, the dyspepsia will not entirely cease. One of the most potent causes predisposing to dyspepsia is tight lacing, by which the stomach is compressed and often displaced. The stomach, duodenum and liver are the organs occupying a position to be most affected by this pernicious habit.

"Dyspepsia" is a popular term used to designate complex and multiform conditions, which may result from inflammation of one or more of the organs of digestion or perversion of their secretions, or from the presence of ferments and bacteria. And know, ye dyspeptic, that there is no short and easy road to cure by pepsin, pancreatin, and patent tablets and elixirs. The remedy that relieved your neighbour, with his excess of muriatic acid in the gastric juice, may be poison for you in whom it is deficient. His sour stomach may have been due to too much natural acid, yours to butyric acid, the result of putrefaction. Dyspepsia is

usually due to errors of diet as an exciting cause, following upon numerous predisposing causes. It can be relieved by medicine, but cured only by removing the causes. That being done, treatment judiciously prescribed may hasten the cure, and in some cases may be necessary for its accomplishment. It is due to so many causes, and is characterized by so many complex conditions, that it is folly to suppose that every case can be cured by the same means, or that any system of treatment will be efficient in all conditions. It is impossible to prescribe diet without knowing the peculiarities of each individual case and studying the question of personal idiosyncracy. An attempt has been made in this and the following chapter, however, to give directions for the various conditions which an intelligent person can adapt to his own requirements.

In deciding upon the quality and quantity of food required by an individual, many factors must be considered. Climate, season, age, mode of life, previous habits, character of exercise, occupation, and personal peculiarities must all be considered. In cold climates, and during the winter months in the so-called temperate zone, there is a demand for much animal heat. Heat-producing foods are indicated, therefore. The Eskimo enjoys

the delicate flavour of a tallow candle, but the Filipino could hardly be expected to appreciate it. It is a common error in the varied climate of the northern States to make but little difference between the winter and summer diet. It would be manifestly absurd to prescribe the same diet for the Laplander and the Hottentot. And yet the extremes of temperature between our "cold spells" in winter and "heated terms" in summer are almost as great as would be experienced in going from Lapland to Africa. It is my firmly grounded belief that a moderate and rational amount of meat, fat, and oil is advisable in the winter diet of most people. In the summer they should be diminished, and a greater proportion of fruits, vegetables, and cereals should be taken. Moreover, the quantity of aliment should be reduced in hot weather.

Age is another important element in the selection of diet. Other things being equal, a vigorous young adult requires more food than does a person in middle and later life. The rule should be, after forty, to diminish rather than increase the amount taken, and to use greater caution as to its character. Rich, made-up dishes should be avoided, the meat should be reduced, and pastry and rich desserts should be taken very sparingly. The flues and

waste-pipes of an old engine are more readily clogged than are those of a new one. Your body is like an engine in that you are taking in combustible material which is utilized in the production of heat and energy. If you take in too much, the unused residue must remain to clog various organs, or must be thrown off, thereby placing undue work upon others, notably the kidneys. While the body is comparatively new it will do this work with readiness. The time will come, however, when it will do it with more and more difficulty, and the point may be reached when it is not equal to the task, and what we call disease is the result. Hence we may deduce one great principle of dietetics, namely, that increasing age demands less, not more, aliment.

Occupation is an element of the greatest importance as regards the diet. A change in occupation and surroundings is frequently not properly considered. The country boy on the farm, who eats fat pork and pies and crullers with impunity, becomes, if transplanted to the city, a dyspeptic on a much more digestible diet. The labourer requires more food than the student, and an entirely different food. Those engaged in active physical labour can dispose of a quantity of nitrogenous food, malt liquor and coffee that would

render the person of sedentary habits irreparably "bilious." Muscular activity requires not only sugar and starch, but an abundance of albuminous food.

Idiosyncracy must explain many peculiarities, both in the character of the food required and the amount consumed. Some people are habitually hearty eaters, and consume large quantities of food without digestive disturbance. Others are habitually small eaters, and maintain a perfect state of health on a surprisingly meager diet. It is absolutely impossible to lay down any rule as to the amount of food which should be consumed by any particular individual. It is unnecessary to be worried over an habitually small eater as long as he is in his usual health and his general condition is good. Many a fond wife and mother has done her husband and children harm by persistently appealing to them to eat beyond their requirements.

The diet of an individual is determined largely by education, social standing, and the habits of those by whom he is surrounded. Habit, in fact, is a very potent factor in the methods of life of all people. Even if habits of diet be bad, it is usually unwise to change them too radically and too suddenly. When extreme and radical changes seem to be indicated, it is advisable to make them

gradually, for serious results sometimes follow the too sudden breaking up of long-established methods of living. It is habit which induces people to go on in certain methods of living in spite of changed conditions. Methods proper under some conditions may be very improper under others, but are perpetuated simply because the individual has been in the habit of doing thus and so.

Upon no question in dietetics has there been more discussion or more extravagant and extreme views expressed than upon that of meat eating. Without entering upon this controversy, let us adopt a standpoint upon middle ground, hoping that it is the golden mean where the most truth lies. This ground may be stated as follows: Meat is a very valuable article of diet of which many Americans eat altogether too much. Properly cooked meat in moderate quantities is readily digested by most healthy stomachs. It contains elements required by the system, notably, the albuminous or nitrogenous principles which are used in muscle and tissue building and are necessary to replace tissue waste. A certain proportion of such elements is necessary to vigour and good health. They may be found, it is true, in many vegetables, but the animal albuminoids possess properties of peculiar value. Acknowledgment of this fact

should not be construed into the theory that we cannot eat too much meat. The nitrogenous matters of the food must pass through many complex changes before they can be eliminated from the body. They are, indeed, particularly difficult elements to get rid of. This in many cases, rather than the question of their digestion, is the reason for curtailing the quantity taken. Their retention in the body increases the tendency to uric acid and the gouty and rheumatic conditions, and places additional burdens upon the kidneys. Hence, their excessive use may not be desirable, even if they are well digested.

The amount of muscular exercise must determine more than any other one factor the amount of meat that may be eaten. The less the exercise, the less the meat. "No one but a wood-chopper or a hunter can possibly eat red meat three times a day without inviting uric acid to come and take up its dwelling in his system." Gout is more common in this country than is usually supposed, while "poor-man's gout," or the uric acid tendency, is everywhere. Meat once a day, at dinner, is as much as most well-to-do denizens of the city can dispose of. Some salt meat or fish at breakfast is not precluded. During cold weather, or when some unusual exercise is to be taken, chops or steak in

moderate amount may be added. In fact, it is often better to take meat in moderate quantities twice a day than to take a larger amount at one time. A lesson might be learned by the three-times-a-day meat eater by watching a gang of hardy and hard-working Italians at their luncheon, composed chiefly of vegetable food.

It is difficult for those accustomed to eat meat three times a day, making it the principal article of diet, to radically change their habits. The high flavour of meat and the dishes containing it make other diet seem insipid and tame. The element of habit is here very strong. It can be overcome, however, and quantities of nutritious and palatable dishes are available as a substitute for meat. With milk, butter, and eggs, with fish, shell-fish, and fowls, with vegetables, cereals, and fruits, it is a poor cook who cannot produce a palatable and sustaining breakfast and lunch.

This meat question is not a new one, as shown by the following quotation from George Cheyne: "Much animal food and strong liquors seem not to have been designed for Man in his Original Make and Frame, but rather indulg'd to shorten the Antediluvian Length of Life, in order to prevent the excessive growth of Wickedness." This may certainly be used in support of the theory that a

man's conclusions are often better than the arguments he uses in reaching them.

After meat, probably the most frequently discussed and most maligned article of diet is bread. "Throw white bread to the dogs—though it will kill them if fed exclusively on it," says a recent health journal. And so will brown bread and any other single article of similar character. This is a fair sample of the kind of argument used against one of the most wholesome and valuable articles of diet at the command of modern man. These attacks, made by the apostles of so-called health foods, are injurious in the extreme, as they lead to the use of foods inferior in every respect to the one they attack. Wheat is the most valuable cereal that has been known to man, and it is a great blessing that in recent times it has become available for the use of the poorest. Of its various products, well-made white bread is the best. But we are told with great positiveness that it will kill dogs. We must eat brown bread because it contains the phosphates and mineral matter. From the persistence with which the phosphates have been vaunted by the health-food writers and patent medicine men one might think they were the most important elements to be sought in diet. As a matter of fact, they are of very moderate

value, and are found in all varieties of food more commonly than any other mineral element except salt. We do not have to adopt a diet of husks in order to get them. In this fair land of ours, nature has been so generous that we are not obliged to eat wheat bran, corn husks, or nut shells.

The prevalent idea that whole wheat bread is more nutritious than white bread is but one of many errors which result from considering only the chemical composition of food. Although chemical analysis shows that some forms of dark bread contain a little more nutrient than does white bread, digestive experiments conclusively show that, owing to the cellulose with which a part of that nutrient is surrounded, the dark bread is not as completely utilized as the white. According to Bauer, white bread is utilized to within .8 or 1.6 per cent., while from 8 to 18 per cent. of dark bread is unutilized. A European peasant may eat soggy black bread and thrive on it, and a horse can digest oats, but the average American can eat neither the one nor the other with profit. By modern methods of milling, white flour is very constant in its chemical composition. It consists of gluten (nitrogenous element), starch (carbohydrate), and various salts (mineral). It contains, therefore, in ample supply, all the ele-

ments of a complete food except fat. In "bread and butter," therefore, we have so complete and so excellent a food that it has been very well adopted as the synonym for good and liberal diet. Let the breadwinner earn his bread and butter and eat it with his family without misgiving or twinge of conscience.

There can be no objection to dark bread when it is well made. It is often soggy and heavy, so that it forms a doughy and indigestible mass in the stomach. Bread that is light and dry and has plenty of crust is the most digestible. White bread more often fulfils these requirements than does dark bread. The kind known as French bread is especially digestible. Most people tire of the dark bread as they do not of the white. But few can use it exclusively, year after year, without losing their taste for it.

Rice is used by a greater number of the human family than any other cereal. It is the staff of life of the teeming populations of the Orient. While it contains more starch than any other cereal, it has but a trifle of fat and cellulose and but a moderate amount of albuminoid. The starch of rice is very digestible, boiled rice being digested in an hour. Its nutritive value is less than that of most of the other cereals, notwith-

standing the fact that it is so universally employed in eastern countries. In those countries where it is used so largely it is universally combined with oil or some albuminoid matter. As one element in the diet, rice is very valuable, and might be profitably used in this country more largely than it is.

Indian corn contains a large amount of starch and considerable fat. It is somewhat more nutritious than rice, but requires an interval three times as long for its digestion. When largely used by those unaccustomed to it, it is prone to produce intestinal indigestion and diarrhea. To furnish a complete food, corn should be combined with an animal albuminoid and a little fat. Oatmeal is rich in fat, but contains less starch than do the other grains. It has almost as much albuminoid as wheat has. When not sufficiently cooked, it is irritating, and frequently causes digestive disturbances. It is a food which cannot be taken by some people, though the number is not large. Arrowroot, tapioca, and sago are composed almost entirely of starch. They are readily digested, and are especially adapted to conditions of weak digestion. Macaroni consists chiefly of gluten (nitrogenous element), with a small proportion of starch and fat. When plainly cooked, it is

digestible and nutritious. With a large amount of butter and cheese it forms a very complete and rich food, but is digested with difficulty by most stomachs.

The potato is more largely used in this country than any other vegetable food except wheat. It contains a large amount of starch. It is quickly digested, but yields considerable amounts of vegetable acids. It is, therefore, more liable to cause indigestion and flatulence than do most other starchy foods. The vegetables which grow under ground, of the class to which beets and turnips belong, contain a large proportion of starch. They are not digested as easily as are potatoes, nor are they of as much nutritive value. The beet contains sugar, and is the most nutritious member of the family. The group of vegetables which grow above ground, of which the cabbage is a type, are valuable additions to the dietary, although their nutritive value is not great. They furnish the bulk and residue so necessary in the food, but are not irritating or indigestible.

Leguminous plants furnish some of the most valuable of foods. Peas, beans, and lentils are the most important members of this group. They contain a very large percentage of nitrogenous matter combined with starch. They are also rich

in organic compounds, especially those of sulphur, phosphorus, soda, and lime. They are the best substitutes in the vegetable kingdom for meat. Lentils are especially rich in nitrogenous matter and starch. They are among the most valuable of vegetable foods, and are worthy of more general use. Although the fruits are of but little nutritive value, they are important articles of diet owing to their antiscorbutic properties and the presence of certain vegetable acids.

Concentrated food is a fad of recent years. We sometimes hear the prophecy that in a few years we shall be able to obtain all our food in concentrated or compressed form. That time will never come, for the human digestive organs were not designed for such use. They require food which produces a certain amount of residue. A judicious mixture of concentrated and bulky food is best. One of the objections to an exclusive meat diet is its concentration, and of an exclusive vegetable diet its excessive bulk. The modern tendency to seek concentrated food is shown by the many nourishing drinks now in the market. "A food to drink" is not a good thing for the everyday use of the average individual. There are certain circumstances in which a concentrated food is desirable and very useful. Water is one of the impor-

tant elements of the diet. It is the solvent of the solids, which must be carried out of the body to prevent self-poisoning. But when it is saturated with solid matter it cannot take up more, and one of its most important offices is not fulfilled. The small amount of solid matter in tea and coffee does not materially effect its action. Milk, it should be remembered, though a liquid outside the body, becomes a solid upon entering the stomach, often a very tough and leathery one. It is a rich food, and should be taken as such, and not simply as a drink with meals. The concentrated foods have their places, and are invaluable in many conditions of modern life, but it is a mistake to make of them permanently a large part of the diet. An exclusive diet of uncooked food is an old idea recently revived. It is unphysiological, and a very foolish fad.

The drinking of fluids with the meals is objected to by most writers on dietetics, the criticism usually being made that it dilutes the gastric juice and thus retards digestion. This is but partially true. The excess of fluid is soon absorbed, if the stomach be in a healthy condition, and the proper proportions are thus maintained. In a weak and diluted stomach, however, this may not occur. The chief objection to drinking at meals is the

tendency to wash down the food without sufficient mastication. A habit which most people can adopt to advantage is the drinking of water before breakfast. It is best to take it as hot as possible, and to sip it very slowly. If it is lukewarm it may cause nausea. When hot water is not available or is not agreeable, cold water may be taken. It acts, in fact, more satisfactorily with some individuals than does hot water. This morning draught of water clears the mucus from the stomach and tones it up to its work. To elderly people, and to those whom George Cheyne would call tender persons who are inclined to be depressed and chilly in the morning, the draught of hot water is sometimes very comforting. It is better than tea or coffee, though there is little objection to them at that time if they are taken very weak and without milk.

For many people the importance of water drinking is very great. Those who are stout are inclined to be large water drinkers, and for them the amount must often be restricted. Many who require it most, on the other hand, are inclined to be small water drinkers. Those who are subject to so-called chronic rheumatism, uric acid, gout, or kidney troubles should make it a rule to drink freely of water. It is needed to dissolve and carry

out of the system various poisonous compounds resulting from tissue waste. Deficiency of water is one of the numerous causes of constipation. An increased supply will sometimes markedly relieve that troublesome symptom, particularly if taken freely before breakfast. Cold water taken in moderate quantities and at frequent intervals during the day not only acts as a flush to the stomach and intestines, but tends to improve the appetite. It also stimulates the liver, heart, kidneys, and skin to a healthy action. Its effect on the kidneys is not only to increase the watery but also the solid constituents of their secretion.

A few words may be said regarding two commonly used articles of diet—sugar and cereals. The use of sugar has enormously increased during the past thirty years. It is the common impression that it is not properly a food, but a deleterious agent used to make food palatable, which by habit has become a necessary evil. This is a great error. Sugar is an important food element for the human animal. While cow's milk contains but four per cent. of milk sugar, breast milk, designed by nature as the baby's food, contains seven per cent. This is four times more than the quantity of the caseine, and almost twice that of the fat. It is one of the fattening elements of the diet. Artificially fed

infants who are deprived of an adequate quantity of sugar do not acquire sufficient fat. In the adult body it is one of the most efficient producers of fat, as well as a generator of animal heat and vital force. It is a valuable food for labourers and those who take much muscular exercise. This fact was appreciated by the Government, which sent especially large quantities of sugar to the army in the Philippines during the period of most arduous labour. The chief drawback to the use of sugar is its tendency to cause an acid fermentation in the stomach. Taken as candy between meals, it disturbs the digestion and impairs the appetite. Used excessively by young girls and boys, it is apt to be a generator of pimples. Those living a sedentary life should eat much less of it than those who exercise freely. Moreover, it is one of the food elements in which idiosyncracy plays an active part. It does not agree with some people. They should take it in moderation, and not be too critical of those who can take it more freely. It scarcely needs to be said that many people eat too much sugar, while enormous quantities of candy are given to children which they would be far better without.

Methods of cooking have a great influence in rendering food wholesome. This is markedly so

with cereals. By proper cooking and a little training in their use there are few people who cannot make them an element of their dietary, and a very valuable one. They have been brought into disrepute in many families by the use of the so-called cooked cereals, which are alleged to require little more than heating to render them ready for use. Half-cooked cereals are a common source of intestinal indigestion. This is particularly true of oatmeal, which requires prolonged cooking (rarely less than six hours), and steam-cooked requires almost as long as does the uncooked. It cannot be properly cooked in the morning before breakfast. What is to be served in the morning should be put on the range in the evening, in a double boiler, with plenty of water, and allowed to cook slowly all night.

Many wholesome articles of diet are rendered indigestible by the usual methods of cooking. Mushrooms, for instance, are among the most nutritious articles at our command, but the manner in which they are usually cooked renders them difficult of digestion. Lobster has acquired a much worse reputation than it deserves because of the abominable combinations in which it is frequently served. The process of frying permeates the food with fat. Fat is not digested in

the stomach. Hence, in fried food the gastric juice cannot reach the albuminoids and connective tissues, and they pass from the stomach undigested, to cause intestinal indigestion.

The tea and coffee question is another subject upon which extreme views are held. As is the case with all articles of their class, the element of personal peculiarity is very prominent, and people are inclined to draw positive conclusions from their own experience. Coffee will cure a headache in one and cause it in another. Tea will keep one person awake and help another to sleep. Every rule regarding their use is subject to the question of personal idiosyncracy. Out of all the turmoil, there is no adequate evidence to show that the moderate use of tea and coffee does most individuals harm. The term moderate use is difficult to define, but it does not mean three times a day for sedentary workers. When taken strong in large quantities at every meal or between meals, they may be very injurious. To take them in place of food, or to keep up one's strength and nerve power, is the height of folly. Tea steeped till it is black with tannin and extractives, and taken in large amounts, is capable of causing one of the worst forms of acid dyspepsia. It is the cause of much of the dyspepsia of American servant girls, and

dyspepsia is indigenous to them. It is one of the underlying causes of the "servant question." The strong young girl, accustomed to a simple life and plain diet, who has rarely been ill, comes to America and enters domestic service. Within a few months she almost invariably becomes anemic and develops dyspepsia. Tea is one of the chief causes. Other contributing causes are unwonted confinement to the house and eating the richest and most indigestible portions of the diet which the kitchen affords. This, with frequent draughts of tea which stands on the back of the range all day, is adequate explanation for the prevailing dyspepsia of servants, and, as a corollary, many of the woes of modern housekeeping. It is a subject worthy of the attention of some of the good people interested in improving the condition of domestics. Many of these foreign-born domestics present some of the most picturesque examples of dyspepsia, "the American disease."

Coffee diminishes tissue waste and thus temporarily renders a less amount of food necessary, but is itself in no sense a food. It is, therefore, clogging in its action. This may be very desirable in those engaged in active muscular labour in whom tissue waste is very rapid. It is manifestly less desirable in those of sluggish habit or sedentary

occupation. Even more than in the case of meat and sugar, the use of coffee should be graduated according to the amount of physical exercise taken. The action of tea in the system is quite complex, but it does not diminish tissue waste to the extent that coffee does.

In referring to a tendency of those who have found some particular combination of nourishment suited to their own stomachs to infer that it will be equally acceptable to the stomachs of their neighbours, Sir Henry Thompson asserts that it would be no more preposterous to assume that a shoe adapted to one's own foot will be equally adapted to those of one's neighbours. Feet probably do not differ more than do digestive organs. But it is possible even in the matter of shoes to lay down some general rules. For mountain climbing, thick-soled tans may be worn; with evening dress, thin patent leathers. While shoes may be light and thin in summer, they should be heavier and thicker in winter. The exact style and finish, however, may differ with each individual. And so in diet we may lay down certain general rules, leaving the details to be modified by each person applying them:

The diet of an ordinary individual in health

should contain a variety, not one of the great food staples being excluded.

Its character should vary with age, climate, season, and occupation, no one system of diet being adapted to the needs of all.

After the period of growth has passed, and full development has been reached, the amount of aliment should be diminished rather than increased.

The diet of hot weather should be lighter in quality and less in quantity than that of cold weather.

The amount of physical exercise taken should be the chief guide in determining the quantity of the heartier food consumed, particularly meat, fat, sugar, and coffee. The more the muscular exercise the more the food. Active brain workers, however, require more of these foods than do those of similar habits who do not undergo mental exertion.

It is neither necessary nor wise to habitually leave the table hungry, neither is it wise to "eat so much as will indispose for business." Let your moderation be known unto all men. It will neither diminish your own happiness nor impair your reputation.

CHAPTER XIV

The Dangers of Middle Life

In a previous chapter attention was called to the fact that the expectation of life of the infant born to-day is greater than was that of the infant born fifty years ago, while that of the average man of middle age is not so great. It is the object of this chapter to seek the reason for this startling fact, and, if possible, to suggest remedies. Some of these reasons have already been touched upon, but will be here considered at greater length. It has been suggested that the great saving in child life made in recent years has resulted in carrying into adult life many weaklings, who are unable to sustain the burden when the retrograde changes of middle life begin to appear. There is, no doubt, some truth in this, but not very much. The diseases of infancy are such that many perfectly healthy children are stricken and do not recover. The saving in child life has by no means been among the weaklings alone. We must look further for reasons if we would avoid error.

It seems improbable that this reduction of life expectation would occur equally among all sorts and conditions of men. And this we find to be the fact. It is most marked in some of the classes outside of the so-called labouring class. While not confined to cities, it is more apparent in them than in the country. It would be manifestly impossible to offer advice that would be equally applicable to every grade of the social scale. We must therefore eliminate certain elements. There is little satisfaction in shooting at too large a target. We will, in the present chapter, eliminate the "working-man"—a very bad expression, for it seems to imply that labour and toil is not work unless performed by the hands. This class of toilers is free from some of the conditions which shorten life in others. Moreover, "organized labour" has a very lively appreciation of its own personal interests. It is striking in season and out of season for better pay, better conditions, and shorter hours of labour. It is the employer who particularly needs instruction as to how to take care of himself.

The sins of modern society are often attributed to the mad struggle for wealth and power. There is such a struggle past all denying, but it is an exaggeration to attribute everything to it. Where

one man is madly struggling for wealth and power, ten are labouring for a competence and a hundred are contending for sheer existence. Modern society has not been made what it is by any single class, but is the result of many complex forces. No individual and no class can materially change it or stem the current. Most men and women are thrown into that current through no volition of their own, and existence is a struggle to keep afloat. It is the comparatively few who, by special ability and unremitting effort, can radically change their condition in life. But the attempt to do so is not a crime. The strenuous life is not a sin. It becomes so only when it degenerates into a fierce struggle for wealth that is not required, or for power that is sought only for self-aggrandizement. Those engaged in such a struggle we will eliminate, also, from consideration in this chapter. The only advice to be given to such is to stop it and begin the living of a sane and reasonable life. We will eliminate also the body of men, small in this country, known as the leisure class. No advice that could here be given would induce them to materially change their mode of life.

There are great bodies of men, particularly in the larger towns, who from choice or necessity lead the strenuous life in all that that expressive term

implies. By common acceptance, this term applies as much to the mental worker as to the physical labourer. These toilers include the literary, professional, and business men of all classes—all those, in fact, who labour with body and brain and are heavy laden with responsibilities. This adding of *responsibility* to labour is a combination of conditions which gathers individuals of widely differing occupations into one great group having, from the point of view of the physician, many elements in common. It is quite true that every individual, except the tramp, has certain responsibilities pertaining to his own welfare and that of his family. But beyond this, which may be called personal responsibility, there is a steadily increasing number of people in the community whose daily duties consist in the bearing of great burdens of care. The proprietor of the little general store in the country village has his cares and perplexities, but they are scarcely to be compared with the responsibilities resting upon the shoulders of those who manage a great city department store with its several thousand employees. The active members and higher employees of every business firm and corporation have, in addition to their hours of labour, heavy burdens of responsibility. There is perpetual planning, devising, and negotiating to

keep abreast of competitors. As great weariness comes from mental as from physical labour. When the two are combined and upon all are laid responsibility and accountability to others, the burden becomes enormous.

Not only has the number of men occupying responsible positions increased, but the responsibilities themselves have vastly grown with the increase in the volume of the business. The vast business enterprises of to-day entail vast burdens of care upon some one. Compare the responsibilities of the national administration of 1800, which presided over a little country of 5,000,000 inhabitants located along the Atlantic seaboard, with those of the administration of 1900, which has in its keeping the destiny of 76,000,000 people spreading out between the Atlantic and the Pacific and reaching across seas to take control of 10,000,000 or 12,000,000 more. The difference in the nation, however, is not greater than is the difference in most kinds of business. Compare the financial transactions of the banks of but fifty years ago with those of to-day, and remember that, with each increment of business, there is an increase in labour and responsibility for every one of the higher officials. Compare the newspaper of to-day with that of the early nineteenth century. Many

an American town of 50,000 inhabitants now supports a larger paper, and one involving more business enterprise, than did any metropolis of a century ago. Compare the little factories of 1850 with the vast manufacturing establishments of to-day. One industry alone is capitalized at more than $1,000,000,000, while our total exports have almost trebled since 1875. These examples might be multiplied by the score.

All this brings us back to the one word repeated so many times in the last few paragraphs, because there is none other which expresses the idea—*responsibility*. The vast increase in every variety of business means an increase in the number of men bearing responsibility and in the weight of the burdens carried.

It is another peculiar feature of this modern life that these burdens of responsibility are rarely borne for the individual alone. They are carried for others, for almost every man is accountable to some one. The president of the bank or corporation may be satisfied that he has done the best that he could have done under the circumstances, but the question is always in his mind whether his directors will also be satisfied. The employer considers his employees, who are dependent upon the success of his business for their daily bread as

is his own family. The agent, the broker, the manager, the superintendent, the editor, the publisher, the corporation official, are all doing more or less the work of others, and are accountable to others legally or morally. This is particularly true of the professional classes. Their work is almost exclusively done for others, and they are answerable to others for every act. The work of the lawyer and the doctor must be satisfactory to their clients and patients. This is the feature of the daily life of each which renders their labours so trying upon the nerves. Their responsibility, as well as that of the business man, has increased. The great man of the legal profession of old, the criminal lawyer, had but little responsibility as compared with his brother of to-day, who is the legal adviser of great corporations and business houses and has the administering of vast estates. The responsibility of the old-time doctor was also less than that of the physician or surgeon of to-day, of whom so much is expected. These various men of responsibility cannot die, or even take a necessary vacation, without seriously discommoding others or deranging the affairs of their fellow men. Never in the history of the world has that Biblical expression been so true as it is to-day of this army of responsible men and women:

"For none of us liveth to himself, and no man dieth to himself."

The second factor tending to shorten the career of men in active life is the high tension under which their work is performed. This is a high-pressure age, not so much from the choice of the people as from necessity. As the volume of business has increased, the hours have not lengthened themselves to permit its being done in the old leisurely manner. It must be done in a hurry or a part of it will be left undone. The telegraph, the submarine cable, and the telephone have increased rather than diminished the tension of business life. When it required two days for the business man in New York to get a reply to his Philadelphia letter, he was obliged to be deliberate. Now he sits at his desk and completes his deal in Philadelphia by telephone. He does almost a full day's work in New York on Monday, goes to Chicago, transacts three hour's business on Tuesday, and returns to New York in time for the opening of business on Wednesday morning. He completes a half-dozen transactions now where he completed one fifty years ago. Of course, he does it under high pressure.

The old-time merchant, who has been admirably described in several recent historical novels,

loaded his ships and sent them across seas and calmly awaited their return several months later. He could not hurry nor live at a very high pressure if he tried. Opposite this picture set the modern importer in telegraphic communication with the uttermost parts of the earth, whose invoices are arriving by every week's steamers. His lot is cast with those who "hurry to and fro and strive unceasingly." If he does not do the same he will be left behind and his business will fail. Thus another is added to the striving throng and adds to the rush and hurry. The "gentleman of the old school," with his elaborate courtesy, his stately bearing, and deliberate ways, is almost an impossibility under modern conditions, the more's the pity. It is doubtful, however, whether there are fewer gentlemen now than there were a century ago, though they appear under different guise.

A third reason for the condition we are considering is the tendency to concentration of the population in urban communities. Overcrowding is not conducive to health, even for those who live in the better localities. Still, it must be said that for those who can live in such localities during the cold months, and spend a liberal part of the hot season in the country, the conditions of home life are not bad. They are usually better than are

the hygienic conditions where the business is done. But, unfortunately, very few business men can spend a large part of the warm season out of town. Many of them pass the most trying part of the year in a dismantled house, deprived of many of the comforts of home. In many cases it is impossible to obviate this, particularly when there are young children in the family. This summer life of city men is unfortunate from every point of view, and is particularly so for those who have reached or passed middle life. Even were the hygienic conditions of the home life and business always perfect, in the rush and roar of great numbers there is a nervous strain that has a decided influence upon the health, though it may not be perceived at the time.

A fourth reason is the sedentary life, which claims scores of thousands of modern toilers. It is a subject of sufficient importance to warrant consideration in a subsequent chapter.

A fifth, and in some cases a very important, cause of breakdown or shortened life is bad methods of living, or actual dissipation. The overuse of alcohol and tobacco, vicious diet, and sensuality have wrecked many a promising career. These things, in conjunction with one or more of the preceding causes, largely explain the reduced

expectation of life of middle-aged men of the present day. These causes do not usually begin in middle life, but the results of the wrong living in earlier years become manifest at this period. One of the greatest mistakes a man ever makes is to do his work on stimulants. If he cannot do his work this year without artificial strength, does he expect he can do it next year? If he has not sufficient strength to do his work at thirty, what does he expect to do at forty or fifty, when his business will naturally be larger and more exacting? Does he expect to grow stronger as years are added to his age? This daily bracing up with stimulants, so common among young business and professional men, is sheer insanity. If a man is not strong enough to do his work, he ought to reduce it, or, if that is impossible, stop it, and do something else at any sacrifice. Working on stimulants will lead to disaster, mental and physical. If it is persisted in there is no way under heaven given among men whereby a man may be saved. His career will end in failure and sorrow.

A prominent New York newspaper has recently asserted that it is the recreations of modern business men which kill, rather than their work. There are both truth and exaggeration in this statement. Many men are killed by their recreations, in addi-

tion to their work. The breakdown of a very prominent man of affairs has recently been an example in proof of this statement. "It has long been evident," says the New York *Times*, in referring to this case, "that he was maintaining the pace that kills. Driving an automobile at record speed, risking large stakes, and making large winnings at Monte Carlo, sitting up all night and coming to his desk unrested and unrefreshed in the morning, dashing here and there in special trains to save time, and meanwhile keeping his hands on the levers which control a manufacturing business of unparalleled magnitude, he has not only burned his candle at both ends, but in the middle as well." If, in addition to the rush, strain, and responsibility of modern business life, a man makes his recreations more exhausting than his work, he must expect to leave them at an early age. Breakdown is the only possible result.

These conditions (an excessive burden of responsibility, high tension of labour, overcrowding of population, the sedentary life, erroneous methods of living, and exhausting recreations) account largely for the ill-health and breaking down of modern business and professional men.

There is another cause, not universal, but of sufficient importance to merit consideration. This

is a tendency all along the social line to remove from a comparatively quiet to a comparatively exciting life. The farmer removes into the village; the successful business man of the village removes to the large town or city; the successful man of the city has an ambition to complete his career in the metropolis. In each case the new life is strange and untried, and is lived at a higher tension than was the old. Such changes made in middle life are the cause of many disasters, both financial and physical. It seems impossible for many men to understand that success in one place does not necessarily fit them to cope with the conditions present in another, and they enter the new life unprepared for its conditions. They might well learn wisdom from a precaution which railroad managers adopt when they make a radical change in the rate of running trains, as in the new twenty-hour trains between New York and Chicago. They give the engineer an expert assistant known as the traveling engineer. "The running of a fast locomotive requires not only skill, but also nerve, and the duty of the traveling engineer is to sustain the running engineer in the nerve-trying swift runs, until he has become accustomed to the swift schedule." If every man who has an itching to commit himself and all his fortunes to a new and

more rapid career than the one to which he is accustomed would take precautions to prepare himself for such a new life, there would be fewer smash-ups.

Gambling, which is much more common than many people suppose, is a potent cause of breakdown and disaster. The same is true of stock speculation and those forms of business which possess a gambling element. The suspense and anxiety not only keep the mind at a dangerous tension, but bring into play some of the worst passions of human nature. The man who eliminates as far as it is possible the element of chance from his business has done much to insure length of years as well as happiness and peace of mind. The gambling feature in many kinds of modern business is an appreciable cause of breakdown at middle life.

The results produced by these various conditions are chiefly the following: general nervous breakdown (often known as neurasthenia, nervous prostration, or business man's breakdown) and organic diseases, the chief of which are Bright's disease, gout, uric acid tendency, diseases of the liver or digestive organs, and degeneration of the arteries. These conditions rarely develop without premonitions. A red light is usually thrown out to give

warning that there is danger ahead. It is an unwise man who runs by them one after the other without slackening speed. Every man ought to understand, that when he has reached the age of forty-five he has entered upon a period of life in which certain accidents are common. They are not inevitable, and he will be unwise to allow himself to become morbid upon the subject, and be worried by a dread of what may never come. He ought, however, to recognize the fact that this period, like every other stage of life, has its particular dangers, and not run blindly into them. Although he feels and looks young, he should not forget that he is a "middle-aged man."

Certain retrograde changes begin about that time of life, and the fact should not be ignored. The time at which these changes begin varies greatly in different individuals and in different families. It depends much upon the earlier life and inherited tendency. In most men of fifty, who have lived an intense life with its cares and responsibilities, in some of the organs there is what Doctor Holmes would call "a general flavour of mild decay." It may be simply a flavour, very general and very mild, but still the word decay must be spoken. We are unfortunately nct built upon the plan of the "One Hoss Shay," which had

no weakest spot, but ran a hundred years to a day and then collapsed in a most becoming manner and in an appropriate place. We all have our weakest spot, and we are no stronger than that spot, as a chain is not stronger than its weakest link. The insurance examiner is frequently the first to detect it. It may be indicated only by a little albumin or sugar in the urine, an abnormal sound in the heart beat, or a peculiar quality in the pulse. Such things are sufficient for rejection by the company, but in a large number of cases never cause any serious trouble, provided the individual takes warning and begins to live a more rational life. Many a man is living in health to-day who was rejected upon adequate grounds by an insurance company twenty years or more ago. These various organic diseases will be considered in detail in a following chapter.

General nervous breakdown, like the organic diseases, usually shows its danger signals some time in advance. Persistent insomnia in one who has been a good sleeper, unwonted irritability, worry over details of business, loss of power of concentration, prolonged lack of energy, and a dread of grappling with business problems, are warning signals. Occurring for limited periods, they mean little or nothing, and may depend upon some tem-

porary ailment. Any one or two alone may indicate little. Their importance may be easily exaggerated and cause unnecessary alarm. But several of them occurring in conjunction and persisting are danger signals which should not be ignored.

That breakdown is not a necessary result of modern conditions is proved by the fact that many men are to-day filling most responsible positions without physical or mental impairment, while others who have lived the strenuous life in its best sense have reached a hale and vigorous old age. Moderation and temperance in all things, a judicious regimen, regular hours and sufficient sleep, adequate exercise, and wholesome recreations will enable a normal man to bear in safety the burden and responsibilities which the most exacting modern business imposes.

CHAPTER XV

The Prevention of Breakdown

Some of the conditions discussed in the preceding chapter cannot be cured, and must be endured. Overcrowding of the population must be tolerated by most men whose place of breadwinning is in the city. The suburbs, to be sure, are available, but residence there is largely a question of personal choice. Suburban life is agreeable to some and distasteful to others. It is adopted oftentimes because a country life is deemed best for the children. It is frequently a serious question to what extent the health and comfort of the father should be sacrificed for the sake of the children.

Responsibility and high tension of life cannot be escaped by him who lives intensely and aids in carrying on the business of the world. Much, however, may be done in many cases to reduce these burdens as age advances. Upon the first indication of failing powers, either mental or physical, the burden, as far as it is possible, should be lightened. One of the first means of attaining

this end is by cutting off the more distant and least manageable portions of the business. As far as possible, the business should be brought within sight and reach. It is the outlying portions which are beyond personal supervision that cause the most worry. Cut them off and make the business more compact and manageable. Do not keep too many irons in the fire. The watching of each additional one demands additional concentration, and adds to the mental tension. Work one or two fields well and obtain all they will yield, rather than half a dozen superficially; it will be far easier; you will live longer and accumulate as much in the end. "The one prudence in life is concentration; the one evil is dissipation." Many a man has dissipated his vital and mental powers by attempting to spread them over too much surface. Study your own capabilities; be honest with yourself; if you are convinced that you have large business capabilities, do not over-restrict them. But do not make radical changes, nor undertake entirely new kinds of business after middle life. You may not fail; but success will be purchased at too great an expenditure of vital and nervous force.

Many Americans maintain a higher tension of life than is necessary. The delirious style of doing

business is partly habit, and in some cases is done for effect. Men often keep themselves in a nervous state and do more rushing about than there is any necessity for. They keep themselves keyed up to such a pitch that they use up as much vital force in doing routine work and unimportant details as in negotiating great transactions. Like the yellow journals which print enormous headlines for the most trivial matters, and work themselves into an excitement over commonplace events, they give undue importance to details, and do everything at high pressure. These high-pressure methods engender laxness in self-control. Men permit themselves to become excited over trifles, and fly into passions of temper over trivial shortcomings of subordinates or at fancied insults. They do not put sufficient control upon their nerves, but allow themselves to be continually annoyed and excited. They get into a combative state, and are continually looking for trouble. They come to live in a tremor, and are irritable and unhappy. All this impairs their judgment, and renders them capable of making mistakes and incapable of doing good work. It is a tremendous drain upon the vital power. Many a man helps to bring on a breakdown by living a life of unnecessary tension and using

up his vital power through failure to control himself.

It is unwise for a man to assume so much business that he will be obliged to labour up to the full extent of his powers. There should be some allowance made for emergencies when the business will suddenly be increased. Anxiety and worry are more exhausting to the physical powers than actual labour. They cause rapid anemia, and loss of flesh. When worry is added to responsibility and exhausting labour, the breaking-down point is brought many times nearer. It is a common experience of the physician to see business men go on without apparent difficulty until a period of panic and financial depression comes, and then break down at the time it is most important for them to be on duty with clear heads. It is an insane captain who loads his craft to the water-line because he is lying in a quiet harbour. It requires no nautical skill to foretell the result when a storm comes on. But that is the risk that thousands of business and professional men are unnecessarily taking to-day. They are allowing no margin for bad weather. The millennium is not here, and the age of panics and business depression is not past.

A word may be said regarding certain classes of

toilers who cannot change the conditions under which they are obliged to labour. They fill the subordinate positions in the great financial and business institutions. They are fixed in a vise, and must perform the duties appertaining to their positions or resign. The duties in many instances cannot be divided or materially lightened, but there are other cases in which the life of the subordinate might be made easier. The long struggle which has preceded the rise to positions of influence and power has the unfortunate effect upon men of some temperaments to harden and render the temper harsh. They are inclined to say that they were obliged to struggle in their time, let the younger men now take the same experience. This is certainly not universal. But the experience of the medical practitioner leads him to think that there is a strong growing tendency to work to their uttermost the subordinate officials of financial and mercantile institutions who carry heavy responsibilities, and often handle large sums of money, and, when they fail to keep up to the standard, drop them and take a younger man, to put him in his turn through the same ordeal. The heads of these institutions have often come up to their positions through great struggles. They should remember, however, that their success has

been partly due to native talent; that all men, even by the same labour, could not attain the same success.

Moreover, while opportunities are greater to-day than they have ever been before, and the rewards of success are larger, the wear and tear in attaining it has greatly increased in the last thirty years. Though there are more places, there are more applicants, and the struggle is more intense. Men will do more work in the same time if they are not held under too high tension. Overseverity defeats its own objects. Prolonged labour without sufficient rest impairs the value of the labourer. The constant fear that any decrease of effectiveness will be followed by loss of position "gets on the nerves" and renders an employee less efficient. The best work cannot be done with overwrought nerves, and under unremitting high tension.

Specialism is not confined to the professions. It is seen in all branches of business and among day labourers. The old-time merchant, whose ships returned laden with all the products of Europe and the East, is supplanted by the importer who buys a single class of goods. Even the department store is an apparent rather than a real exception to the rule. It is an aggregation of different branches of business, each under the supervision

of trained specialists. Specialism has come to be a characteristic of modern life. But where specialism goes, there goes the tendency to fall into a rut, and a rut is a very bad thing to fall into. "When a fellow begins to find out de rut he's in," remarks that young philosopher, Chimmie Fadden, "it's up to him for him to climb out. If he don't get a move on him then, the first ting he knows de rut is so deep he can't climb out, nohow; and dat queers his nerve." It would be difficult to compress more truth into so little space. The only advice that could be added is a warning against getting into a rut in the first place. It is easier to keep out than to get out.

The young man, when he chooses his life work, whether it be a profession, business, or trade, puts his whole mind and strength into it, if he be the right kind of young man. The more determined he is to succeed, the more intensely does he apply himself to his work. He associates with others doing the same work. Their ideas become his ideas; their ways, his ways. He finds so much to learn that he is inclined to eliminate from his reading and his thoughts all other interests. "The lyf so short, the craft so long to lerne," he restricts himself more and more. He loses interest in other matters. Work becomes a second nature,

and he is uncomfortable when not at work. As he grows older he restricts his work, perhaps, to a limited portion of the business or profession to which he belongs. He is apt to magnify the importance of his own special work, and minimize that of others. His field of vision becomes narrower; he settles into certain fixed beliefs, and adopts certain methods of doing things. His life degenerates into a routine, and before he knows it he is in a rut. He loses his interest in outside matters, and is unhappy if he tries to take a vacation. He becomes irritable, and is only contented when in the harness. As time goes on he does not do his work with vigour and energy, as of old, but dawdles and becomes fussy, and wastes time over details. He feels that there is but one way of doing things, and that is his way. Therefore, he will not leave work to subordinates which they could do as well as he. When a man detects these various symptoms in himself he may be sure that he is in a rut. There is then one thing to be done—to make a vigorous effort of the will and get out of it. If he cannot take a vacation without being restless and unhappy, then a vacation is what he needs. He should force himself to rest. If he has lost his taste for fiction, then he should read a few good stories each year, and spend some time upon light

literature. If he has given up amusements, he should begin going occasionally to a few good wholesome places of amusement. He should visit his friends and renew the old acquaintances he has dropped. In a little time, these things, at first irksome, will become pleasures, and he will be taken away from his cares and his business worries. Gradually he will find that he is getting out of the rut, and is doing his work not only easier, but better.

One of the serious features of life in a rut is the fact that judgment is impaired. Allowing the mind always to dwell upon one subject, and keeping the attention always fixed in one direction, destroys the power to draw correct conclusions, and leads to the adoption of distorted and peculiar ideas. The sense of proportion is lost. "They who always labour can have no true judgment," says Burke. Those who get deeply fixed in a rut almost always become more or less "queer" as they grow older. This impairment of the judgment and one-sided way of looking at things lead to the adoption of hobbies and weird and extreme doctrines. This is one of the reasons for the prevalence of *isms* and queer theories. Many of those who adopt them, even though successful in business and professional life, have lived so long in limited and restricted

channels that their judgment in matters outside becomes impaired. Their views are narrow and restricted, and their lives run along a single channel. If by chance they make an excursion outside of it, their knowledge of the country is so limited that they are apt to get lost, and either become mired in some bog of superstition or are taken in by some community of fanatics.

The wise man keeps out of ruts. To be certain, however, that he will accomplish this, he must begin early in life. He must not begin his life work by restricting himself absolutely to a certain channel. This does not mean that he should scatter his forces and attempt everything, or should not become a specialist. But the more strictly he specializes, the more certainly should he see to it that he does not become narrow and bigoted. The young man should early begin the habit of reading a newspaper. It should be a real newspaper, and not a yellow journal which will cause his mental and moral standards to degenerate. He will thus get a general education he can obtain from no other source. But he cannot get all the education he requires even of public affairs from the newspapers. Let him not make this error. Their news is necessarily fragmentary. He should read regularly one or two good monthly magazines

of the class devoted to the discussion of questions of public interest. He should read a little good fiction, as well as history and general literature. While he should persistently seek the acquaintance of the best men of his own craft, who are usually the broadest minded, he should also seek friends outside of it. They will help him to see that there are other important crafts in the world besides his own. All this will broaden his views and help to keep him out of a rut.

If he finds he is becoming a specialist (the term is used in its broad sense to include any man who restricts his business to narrow limits), he should adopt further measures, even to the taking up of a fad. "Fads constitute a mental antitoxin to the poison generated by cerebral overactivity," says Pyle. This has been a measure adopted by many intense workers. William H. Vanderbilt believed that his life was prolonged by the daily driving of his horses, which he took up as a means of diverting his mind from the cares of business, rather than for pure pleasure. His eldest son died a comparatively young man, largely as the result, it was believed, of too close application to business. Chauncey M. Depew has repeatedly said that public speaking is for him a method of recreation. Literature has been adopted by Roosevelt,

Gladstone, Disraeli, and many others. Lord Salisbury is a scientist of large attainments, and has always done much work in his laboratory, which is one of the best in England. He adopted this means of escape from the crushing cares which rest upon the virtual head of a great empire. The present Prime Minister takes refuge in literature and golf. Some men adopt hunting, fishing, golf, and similar sports. Others choose photography, microscopy, or become collectors of this or that, or make themselves experts upon some branch of art. Others, with a musical talent, become proficient in some branch of that art. The point is simply this, that it is wise for a person to take up some subject for which he has special liking or aptitude with which he may divert his mind from the anxieties and worries of his daily work. It is not a theoretical proposition, but an eminently practical one, which has been utilized for years, and is utilized to-day more than ever before. Elaborate fads like literature, music, and art are not necessary. A prominent and very successful New York lawyer has a fad for baseball. He is a frequent attendant at the league games, where he enters into the spirit of the sport, and obtains complete relaxation from professional cares. During other portions of the year he

escapes from them in public speaking, which native talent and experience enable him to look upon as a relaxation. Some simple and inexpensive means of diversion are within the reach of every one.

A well-known New York physician used to say that he could do a year's work in eleven months, but could not do it in twelve. The annual vacation is one of the most efficient defensive weapons against breakdown for those who live the intense modern life. If it be a sedentary one, the necessity of the vacation is the greater. It is greater still if it be like that of the busy doctor, which knows neither evenings nor nights, Sundays nor holidays, but is an unremitting grind, month after month. The vacation is one of the most potent aids in helping to keep out of the rut into which the daily routine of life tends to force one. One or two days a week during the summer do not afford sufficient rest for the hard-working business man. They are very beneficial, but do not permit him to really step from beneath his burdens and feel that he is free from care. I appreciate fully that it is very difficult for many men, and absolutely impossible for others, to escape from their responsibilities for more than a day or two at a time. It could often be done, however, if its

importance were appreciated. Many a man has learned a lesson from an illness. After years of closest application to business he has been forced by disease to remain away from business, and has been surprised and a little annoyed to find that affairs moved on pretty well without him. It is the duty of every man to attempt to arrange his affairs so that he may leave them to others if it is necessary. Accident or illness may come to any man without warning, and they are rendered far more serious by worry over business. If he prepares for such emergencies the best he may be able, he will find it easier to arrange for a vacation. If he decides upon it in a half-hearted way, to be taken if convenient, he will probably not find it possible. If the time is set for it with the full expectation of going away when the time comes, affairs are much more likely to arrange themselves favourably. The way to take a vacation is to set the time and take it when the time comes. There is some locality, north or south, favourable for a vacation at every season of the year. If it cannot be taken in the summer, it may, perhaps, be arranged for at some other season.

After fifty, the importance of the annual vacation becomes greater each year. A man should rid himself of the idea that a vacation is a simple

matter of pleasure or a mild form of dissipation. He should regard it as a duty to himself and to his family, and should plan for it as a necessary hygienic measure. Even though he goes into the country each night, he should, if it is possible, stay entirely from his business for two weeks at least, and longer if he can. As there are many men of many minds, so there are as many ways of spending a vacation as there are individuals. The one rule should be to live a life different from that of the rest of the year, taking the precaution not to overdo the strength. The man of sedentary habits, unaccustomed to vigorous and protracted exercise, may destroy much of the good of his vacation by entering at once upon mountain climbing, extended tramps, prolonged bathing, or excessive exercise. Some people seem to be possessed of the demon of unrest when they get into the country, and act as though they expect to atone for the sins of their months of sluggishness by a few weeks of overexercise. As a rule, exercise during vacation is overdone rather than underdone.

The summer hotel, the cottage, or the camp may not be as comfortable as the home. But if people stay at home they will stay also in the rut. The most valuable result of a vacation is to get busy men and women out of their ruts, to take

them away from themselves and their everyday cares, and remove them from their usual routine of life. If it is rationally spent, it is worth all that it costs in money and trouble.

There is one important class of city workers whose members need vacations but seldom get them. They are the wives of well-to-do business and professional men, and women of the wealthier classes, who do not belong to the ultra society set. They live in private houses or expensive apartments, and have most of the things they wish for in life except rest. The routine of their lives consists in supervising their households, managing the servants, planning the meals, caring for the children, keeping their wardrobes up to date, and performing more or less exacting social duties. In the summer the household is transferred bodily to a "cottage" or "camp." It must be supervised as in the city; the servants must be managed; the endless routine of meals can never be forgotten; the children cannot be neglected; the social duties, though different, are always present, for a series of guests must be entertained. And so this woman, fortunate in most things, is a prisoner to routine summer and winter alike. One of these women recently told me that in nine years of married life she had had

but a month's freedom from this routine. And yet people wonder that these women have nervous prostration or some other form of breakdown. Husbands are sometimes very obtuse, and seek every cause but the right one. This summer cottage life is vastly better for the father and the children than hotel life is, but it has its disadvantages for the wife and mother. She is the only one of the family who gets no vacation. This is obviated in many cases by taking the meals in a nearby hotel or club-house. When such an arrangement is not possible, an effort should be made to give the wife a respite from these ever-monopolizing household cares for at least a short time each year. The high tension of modern life does not affect the men alone. Their wives feel it as well. With the rapidly increasing scale of living, the management of a household is now far more difficult than it was one or two generations ago. The average woman at the head of a city establishment to-day keeps more servants, disburses more money, and has more responsibilities than her mother had, and vastly more than her grandmother. The wear and tear upon her physical and nervous systems is correspondingly greater. The modern woman needs an opportunity to get out of the rut as much as her husband does.

"If men would but observe the golden Mean in all their Passions, Appetites, and Desires; and if in their Gratifications they followed the uncorrupt Dictates of Nature, and neither spurred her on beyond her Cravings, nor violently restrained her in her innocent Bias, they would enjoy a greater Measure of Health than they do, live with less Pain, and die with less Horror." These words of George Cheyne are full of wisdom, and their observance would correct much erroneous living. One of the most common causes of breakdown is faulty diet. One point, alone, may be referred to here, namely, the luncheon of many business men. Go into a downtown restaurant in New York near noon, be it cheap, middle-class, or high-grade, and take note of the stuff that composes the lunch of many of the men, presumably sane. It often tends to shake one's respect for human nature. It demonstrates what some men are capable of when out of the protecting care of their wives. Some of these men we know will seek sympathy at home because of the cares of business life when the real trouble with them is downtown-lunch dyspepsia.

Irregular hours and too little sleep are other factors in causing early breakdown. Sleep is an absolute requisite of nature. Different temperaments require different amounts of sleep, but there

are very few who can keep healthy and well on less than eight hours. Continuous curtailing of the sleep, even if it be slight, is more serious than the occasional loss of many hours. It renders the mind heavy and sluggish, and few other things will so diminish the power to do good work. In time even a small daily loss will tell upon the health. If to this is added frequent heavy losses of sleep, with eating and drinking late at night, by a man who carries heavy business or professional burdens, we have all the conditions for disaster soon after middle life. The irregular life of the society man or man-about-town cannot be combined with that of the strenuous business man with impunity.

The subject of tobacco is necessarily included in this chapter. Like all elements which have an effect upon the nerves, it differs widely in its action upon different individuals, and no sweeping statements can be made. Upon most constitutions its action is deleterious. It is always injurious before the period of complete development, and cannot be used before the age of twenty-five without harm. Doctor Seaver, Director of the Physical Laboratory at Yale, tabulated the record of the students entering that university during nine years, when all the young men were examined and measured. The smokers averaged fifteen

months older than the non-smokers. They were also shorter in stature. Nicotine interferes with growth, and its effect in that regard is very measurable. At Yale, during the four years' course, the non-users of tobacco, although taller when they enter, gain 24 per cent. more in height and 26.7 per cent. more in girth of chest than do the habitual users. Doctor Hitchcock, of Amherst College, found even greater differences. The difference in the lung capacity is very striking in the two classes, and has been noticed by all observers. It shows the effect of tobacco on the respiration, nicotine being a potent motor-depressant. As regards the effect of nicotine on the mental processes, it is more difficult to interpret the meaning of statistics. Out of the highest scholarship men at Yale, only 5 per cent. use tobacco, while of the men who do not get appointments, 90 per cent. use it. It is not necessary to interpret this as meaning that mental decrepitude follows the use of tobacco by young men, for there are other factors to be considered, but it is certainly not conducive to the best work.

Nicotine is the most active element in tobacco. Its immediate effect is to lower the circulation, quicken the respiration, and excite the muscular system; its final effect, to cause general relaxation.

In "tobacco heart" the heart's action becomes irregular and irritable, and the walls are hypertrophied or thickened. There is no cure without stopping the tobacco. The tendency to increase the amount of tobacco is almost irresistible. It is a safe and wise rule for the user to occasionally take honest account of the amount used and reduce it half. If tobacco could be banished entirely, there would be fewer irritable and nervous men in the community. We may once more quote our old, old friend, George Cheyne: "Smoking tobacco may be useful to flegmatic Constitutions, but to dry and lean Habits it is pernicious. Snuff is just good for nothing at all."

With the possible exception of bad diet and methods of eating, alcoholic drinking is the most fruitful cause of human breakdown. The physical questions are so interwoven with the moral that it is a very difficult subject to write upon from the standpoint of physical effects alone. The dangers of excess and habit, and the sad results when it becomes the master, are universally recognized. Its power to cause suffering and ruin need not here be entered upon. One point only will be considered—the physical effects of so-called moderate drinking. This commonly used term is indefinite, for what is moderation for one

may be excess for another. We may say, in its stead, the daily or frequent use of considerable amounts of alcoholic drink, but not sufficient to cause symptoms, and perhaps never intoxication. In speaking of those men who thus drink and think it does them no harm, Doctor Osler, whose opinion is respected by medical men on two continents, speaks as follows: "During the fifth decade, just as business and political success is assured, Bacchus hands in heavy bills for payment in the form of serious diseases of the arteries or of the liver and kidneys, or there is a general breakdown." This is a statement of a physiological truth in very plain and unmistakable language. While a few constitutions seem to tolerate much more than the average, the fact remains that alcohol is an insidious, treacherous, and dangerous element. Its use in considerable daily quantities is always productive of harm.

Again it may be said that breakdown is by no means a necessary result of our intense modern life. There is more to provoke it than there has ever been before, but at the same time we have more means at our hand to prevent it if we will utilize them.

CHAPTER XVI

Diseases Common to Middle Life

There are several diseases whose occurrence is particularly common between forty and sixty years. Few of them, however, are strictly limited to that period of life, and none are inevitable to it. Much may be done by care and right methods of living to prevent most of them. The most important of these diseases are Bright's disease, degeneration of the arteries, gout, the uric acid condition, diseases of the liver, fatty degenerations, heart disease, diabetes, obesity, and cancer.

These diseases may be characterized as personal diseases. By this I mean that they are the result of inherited or inherent tendency, or the outcome of personal habits or modes of life. They are the natural outgrowth of temperament, habit, and environment. They differ materially in this regard from the infectious diseases, which do not depend essentially upon temperament or inherited tendency, but come as accidents come. The child of a gouty family is no more or no less liable to con-

tract measles upon exposure than is one of a rheumatic or tubercular family. Individuals of all temperaments become ill with typhoid fever if they take typhoid germs with their food. Moreover, the infectious diseases run a very similar course in different patients, passing through the same stages and being subject to the same complications. They are, in fact, accidents, and may suddenly befall those who are in perfect health. They are, therefore, among the most preventable of diseases. Railroad accidents sometimes occur in spite of modern inventions to prevent them, but they are no longer looked upon as inevitable, or as acts of Providence. The best-managed roads have fewest accidents, and in the same way many of the infectious diseases are preventable, but owing to the tendency of finite man to be careless, and to neglect necessary precautions, they continue to occur. Most of the personal diseases considered in this chapter are preventable also, but in a very different way. Prevention of the infectious diseases consists largely in avoiding the germs that cause them. Prevention of these personal diseases involves perpetual caution and the adoption of particular modes of living. The one involves the occasional dodging of missiles, the other walking along a straight and sometimes

very narrow way. The one requires knowledge and caution at intervals, the other self-control and temperance in all things.

In another regard, these two classes of disease may be called personal and impersonal. Most of the infectious diseases may be prevented in large measure by the public authorities, so that the most ignorant and careless are protected from them. Yellow fever was thus stamped out in Havana. But no board of health can reduce by a single case the occurrence of Bright's disease, diabetes, or gout. Prevention rests wholly with the individual; it is wholly personal. The methods required are prolonged and continuous, and are summed up in the expression so often used in these pages, *right living.* It goes without saying that each disease requires special measures. But the disease being personal and individual, each case requires personal and individual management. It is a fundamental principle among doctors that in most cases the patient must be treated, rather than the disease. This is true even of the contagious diseases, but it is many times more true of the personal diseases. "If a doctor has science without common sense," says Oliver Wendell Holmes, "he treats a fever, but not his man's fever. If he has common sense without science,

he treats his man's fever without knowing the laws that govern all fevers and vital processes."

It is impossible to honestly lay down hard and fast rules which will be adequate for every case, either for prevention or treatment. No one but the quack attempts it. Be assured that the man who claims to have a "sure cure" for one of these personal diseases, without reference to the form of disease or the individual who has it, is a quack, and unworthy of confidence. And yet it is for these personal disorders, which are so largely modified by heredity, temperament, and mode of life, that the greatest number of sure cures are advertised. What would be thought of a doctor who would prescribe for Bright's disease without an examination, or the asking of a single question, upon the diagnosis of a patient so ignorant of disease that he does not know that there are half a dozen distinct diseases going under the one common name? But this is precisely what the patent medicine man does in every case. He offers one method of treatment for half a dozen or more personal diseases, which assume as many forms as there are patients suffering from them. There are methods of treatment proposed which guarantee perfect health through the following of a few rules, each more absurd than the other. Such systems

of treatment, being simple and easy to follow, are captivating, and have their vogue until their inadequacy is discovered. Any system which lays down a few arbitrary rules which are positively asserted to apply to every case will secure a certain popular favour. The man who has no hobby to exhibit to the public, and no financial ax to grind, finds the subject of dietetics and the prevention of the personal diseases a difficult one to handle. The people persistently cry "Show us a miracle," but there is no miracle which the honest man can show. There is no simple list of rules the following of which will insure to every one perfect health. There is no short cut, or path that is perfectly easy. The royal road to health is the rather irksome one of self-control, moderation, and temperance in all things. In these pages I have attempted to be as explicit and definite as the subject will permit, but in personal diseases the personal element can never be ignored. It will persist in thrusting itself forward, both in theory and in practice, to render sweeping statements and positive assertions impossible if truthfulness is preserved.

It is in the treatment of such conditions that the skill of the experienced physician is most manifest. If every one inherited the same tendencies, pos-

sessed the same bodies, and had suffered from the same diseases, the practice of medicine would be comparatively easy. Many people forget these factors, and suppose that each disease is an entity which appears the same in every patient. They seem to think that a doctor has certain prescriptions for certain diseases, and, the diagnosis having been made, he merely uses the appropriate prescription. I once received a letter containing not a word of explanation, but asking me to send as soon as possible my "best prescription for Bright's disease." A patent medicine man could have answered, of course, without hesitation. A judge would be unwilling, even if he had the power, to pass sentence upon a person who was said by some one to have committed a certain crime. He would hear and sift the evidence, and make the penalty fit the crime if one had been committed. And so a careful and competent physician holds court upon every case, sifts a mass of confused and often conflicting evidence, and prescribes the treatment which his judgment leads him to think is indicated. Thus, to two patients having a disease bearing the same name, he may give entirely different prescriptions, and advise a radically different diet. A tailor who would advertise that he made all coats of one piece of goods, and of one

size, would not do a lucrative business. But his neighbour, the patent medicine man, who advertises one medicine for every case, will become rich if he advertises enough and keeps a sufficient number of clerks employed in writing testimonials. The boy and the geese who now adorn so many public places are a most apt satire upon the people who buy cure-alls. If a clever and competent physician were to advertise his own skill as the quack does, he would not claim to treat every patient with one prescription, but would rather advertise *treatment to fit.*

BRIGHT'S DISEASE

Under this comprehensive term is included several diseases of the kidneys, whose technical name is *nephritis*. They were first clearly defined in 1827 by Doctor Richard Bright, of England, after whom they were named. Bright's disease may be either acute or chronic. There is a popular impression that the disease is virtually incurable, and a cure is regarded as little less than a miracle. As a matter of fact, acute nephritis tends to recovery, but the chances of recovery are better in young adults than in those past middle life. It is common to all ages. It is caused by exposure to wet and cold, particularly in those under the influence of alcohol. It occurs also in the course of some

of the infectious diseases, especially scarlet fever. It may be caused by overdoses of such drugs as turpentine, carbolic acid, and chlorate of potash. It is this form of kidney disease that sometimes occurs during pregnancy. It is evident that a person who is ordinarily careful in avoiding exposure can do but little more to prevent acute Bright's disease. It may come to him as does bronchitis or the ordinary catarrhal diseases.

Chronic Bright's disease occurs under two distinct forms, the first being known as diffuse nephritis and the second as cirrhosis of the kidney. The first is more common among young adults than it is in middle life. It is sometimes the result of an acute attack, the disease slowly passing into a chronic condition, but it frequently begins insidiously. The use of alcohol, particularly beer, is believed to lead to this form of nephritis. It sometimes complicates consumption and chronic heart disease. When it has continued for a year the probability of recovery is extremely small.

The most characteristic form of Bright's disease, common to middle life, is cirrhosis of the kidney, sometimes known as contracted kidney and gouty kidney. It is chronic from the outset, and is a slow, insidious degeneration of the kidney tissue. The causes in some cases are clearly apparent; in

others they are doubtful, and can never be determined with certainty. Alcohol plays an important part in many cases, but among the well-to-do classes overeating is a more prominent factor than overdrinking. The excessive eating of meat by sedentary workers, and the drinking of much beer, throws labour upon the kidneys which may prove very injurious. The strain and anxiety of business, combined with overeating and lack of exercise, may result in chronic kidney disease. It is much more common in men than in women, and is particularly common among active business and professional men. In England, gout is frequently a cause, and in this country its near relative, the uric acid condition, is a factor in its production. It is not an infrequent disease among active brain workers.

Chronic Bright's disease is determined with most certainty by an examination of the urine. The signs which indicate its presence are albumin and "casts." The absence of albumin at a single examination is not always conclusive in this type of disease, for its amount is rarely large and it sometimes disappears for short intervals. Casts are little oblong bodies which come from the tubules of the kidneys, and are discovered by the microscope. The two found together indicate nephritis.

Notwithstanding this fact, Doctor Osler wrote an article not long since upon the advantages of a trace of albumin and a few tube casts in certain men more than fifty years of age. The explanation of this strange proposition was something as follows: The successful business or professional man, who lives intensely and strives hard to get wealth or reputation, and who takes plenty of food three times a day, with two or three glasses of spirits, and smokes six or ten cigars, is not leading a rational life. The body bears many resemblances to a steam engine. In the one as in the other, fuel, combustion, transformation of energy, and the accumulation of waste materials tell the story of the day's work. The engineer understands his machine, and accommodates the amount of coal burned to the size of the engine and to the amount of work required. The waste pipes, which in the human machine are the kidneys, bear the strain of the extra work when the amount of fuel consumed and energy liberated is out of all proportion to the work demanded. Careless stoking with high pressure for twenty-five years, and bad treatment of the human machine, mean early degenerations, and the waste pipes are often the first to show signs of ill usage. It is a great shock to a man when he is some day informed by an insurance

company that he has been "postponed," and had better consult his family physician. After a period of great distress and worry, he begins to take heart, and on the advice of his physician remodels his mode of life. He restricts his appetite, takes a light lunch and a moderate dinner, gives up whisky and champagne, resigns from six or eight boards, and at fifty starts to live a rational life. "Prospectively," says Doctor Osler, "nothing could have been more advantageous than the discovery in the urine of a trace of albumin and a few tube casts."

Signs of kidney involvement are not uncommon during and after middle life. With proper precautions and the living of a rational life many men who have shown them live for years in the possession of excellent health. In fact, such trouble may not shorten life.

On the other hand, there are some cases in which the discovery of albumin and casts is more serious. Their significance depends upon the form of disease present and its cause, which must be determined by the attending physician. They may mean serious trouble ahead, or may only be red lights which give warning of danger and indicate the necessity of slowing up and running a less rapid pace. But under no

circumstances can they be disregarded with safety.

But little need be said further upon the prevention of Bright's disease. The causes have been explained, and the intelligent man will not find it difficult to deduce modes of prevention. It is easy to say that there should be less work and rush and intensity of living when middle life is reached, and very hard to follow such advice. They probably never alone cause Bright's disease, but may hasten it in certain temperaments in conjunction with other things. But if to this intense business life are added exhausting recreations, late hours, excessive use of malt and spirituous liquors, and above all a heavy and excessive diet, rich in nitrogenous matter, a man need not be surprised when he is nearing fifty if his doctor tells him some day that he has a little trouble with his kidneys. It may not be too late to save himself by a rational change in his mode of living. Not every train that runs into an open switch is destroyed, but there is always danger, and it is safer to take every precaution to keep on the through track.

ARTERIAL DEGENERATION

"A man is only as old as his arteries," is a saying among doctors. The arteries are among the most important organs of the body, and are among the

first to show the changes of advancing years. They receive, however, but little popular attention. The large arteries are very elastic, the arterial tissue being sometimes known as vital rubber. This property enables them to dilate with each impulse of the heart, thus reducing the shock to the organs which the force-pump action would give were the blood conveyed in rigid tubes. The small arteries are encircled with muscle fibers which are under nerve control. They are continually contracting and relaxing, like the pupil of the eye. For example, when food enters the stomach, the small arteries dilate, and an extra supply of blood goes to that organ to carry on digestion. And so every organ and tissue receives a larger or smaller supply of blood according to its changing needs. It is a marvelous and delicate mechanism, and disturbance of its action is necessarily followed by disease.

The first of the retrograde changes which mark the decline of vital power is seen in the arteries. They slowly lose their elasticity and in time become stiff and rigid. They may undergo degeneration in local areas which renders them weak in spots. There is no definite age at which this occurs. In rare instances it occurs very early, the arteries of a man at thirty being like those of a man at

seventy. It is a personal and sometimes a family characteristic. This peculiar tendency cannot be explained in any other way except that "in the make-up of the machine bad material was used for the tubing." To a lesser degree, this tendency is very common. Many an individual of fifty-five or sixty has no better arteries than the average at seventy.

If the arteries become very stiff and brittle, they are liable to break, and apoplexy is the result. This may occur in any organ, but the term is popularly applied to cerebral apoplexy, in which an artery of the brain gives way. As the arteries grow stiff and lose their power of expanding and contracting, the heart is one of the first organs to feel it. Owing to the increased effort to force the blood through the body, it becomes enlarged and undergoes certain changes. The kidneys also feel it early, and arterial degeneration is one cause of chronic Bright's disease. The liver and other organs are also affected. Arterial degeneration—or in other words, old age of the arteries—is one of the potent causes preventing longevity.

While there are a few cases of premature degeneration of the arteries due to personal or family peculiarities, it much more commonly results from the abuse of good vessels. In a majority of cases

its early occurrence is due to causes more or less preventable. Among the first of these are gout and syphilis, which always involve the arteries to a greater or less extent. The uric acid condition, which is so much more common in this country than gout, is also a cause. Next to these are certain toxic elements, of which alcohol and lead are the most important. Chronic lead poisoning is always followed by disease of the arteries, but such poisoning is very rare. Improper diet is also an exciting cause. Excess of nitrogenous food is especially injurious to the arterial system in people leading a sedentary life and showing a tendency to uric acid. Overeating is also regarded by most authorities as a cause, one reason being that the arteries become distended.

On the other extreme from the sedentary workers are those who do severe muscular work. Early arterial degeneration is common in them. The labourers who do the heaviest kind of work are not usually very long lived. The same is true of professional athletes. Violent exertion is not conducive to health and long life, for it overtaxes the arteries as well as the heart. Up to fifty years of age men are more subject to arterial degeneration than are women, but after that age it is equally common in both.

Arterial degeneration and kidney disease are closely associated, but it is often difficult to decide which is the primary and which is the secondary condition. There is a form of arterial disease which may come on without previous kidney affection soon after forty in men who live at high tension and eat and drink a great deal. It is the result of the strenuous life to which is added strenuous self-indulgence. It will be seen that the causes of arterial disease and kidney disease are quite similar. The measures assigned to prevent one are effective in preventing the other. In addition to the usual form of arterial degeneration, fatty degeneration may occur, and is the result of the same causes which produce fatty degeneration elsewhere.

GOUT

While gout cannot be called a common American disease, it is far from rare. It is a disorder of nutrition, one factor of which is excessive formation of uric acid. It is due to imperfect chemical changes in the food stuff during the process of assimilation, combined with imperfect elimination of the waste products. In England, fully three-fourths of all cases of gout can be traced to gouty ancestry. In this country, while the hereditary element is strong, it is not as marked. The trans-

mission is more marked from the male side. A grandson may inherit gout from a grandfather through a mother who has never exhibited any gouty manifestation. When the hereditary tendency is very strong, evidences of the disease may appear in childhood. It rarely, however, develops before the thirtieth year, and in a large majority of cases the first manifestations appear before fifty. After hereditary, the most potent factors in the causation of gout are overdrinking and overeating. Fermented liquors favour its development more than do spirits. It prevails most extensively in countries in which much beer and ale are consumed, as England and Germany. The light beers used in this country are less liable to produce gout than is heavy ale, porter or stout. Food plays a rôle almost equal in importance to that of alcohol. Excessive eating without bodily exercise is a potent cause. The popular impression that gout is solely a disease of the rich is erroneous. An excessive consumption of malt liquors, when combined with poor food and bad hygiene, may readily produce gout of a type known in England as "poor man's gout." Still, the sedentary life is a very potent causative factor.

The action of alcohol in producing gout is thus positively stated by Sir Alfred Garrod: "There

is no truth in medicine better established than the fact that the use of fermented liquors is the most powerful of all predisposing causes of gout; nay, so powerful that it may be a question whether gout would ever have been known to mankind had such beverages not been indulged in." The different forms of alcoholic drink are not equally potent in fostering the gouty habit. Port, sherry, Madeira, Burgundy, champagne, porter, stout, and heavy ales are all gouty beverages. They are far more so than distilled spirits and the dry and sour wines. Drunkards and old topers are rarely gouty, for they usually drink spirits and are not high livers. It is those against whom nothing can be said as regards their sobriety, who become gouty. They drink beer or wine with their meals and "fare sumptuously every day."

The four chief causes of gout, then, are (a) hereditary tendency, (b) the drinking freely of certain malt liquors or wines, (c) the excessive eating of rich food of nitrogenous nature, (d) the sedentary life. Diet and certain other questions will be considered under the uric acid tendency. When the hereditary tendency is strong, no precautions will entirely prevent the occurrence of gout. It has afflicted some of the greatest of men,

and the aphorism is true that "more wise men than fools are victims of gout."

LITHEMIA (URIC ACID CONDITION)

Lithemia is a condition marked by an excessive quantity of lithic acid, or, as it is more commonly called, uric acid. It is closely associated with gout, but differs from that disease in several important features. It is far more common in this country than gout. It has been well described as a motley, ill-defined group of symptoms showing disordered nutrition. Cases are seen in members of gouty families who may never themselves suffer from gout itself. It is seen also in those who have lived not wisely but too well. They are mostly persons who eat and drink largely, live sedentary lives, and have yet been fortunate enough to escape gout itself. In these irregular cases a variety of symptoms occur. Indigestion is very common, there being a particular tendency to attacks of so-called biliousness. There is a tendency to thickening of the walls of the arteries. This may lead to palpitation and more serious difficulties. Headache, migraine, neuralgia, and cramps in the legs are not uncommon. The so-called muscular rheumatism is often a manifestation of uric acid.

There has been a strong tendency in recent

years to attribute all manner of symptoms to uric acid, which have no relationship to it. As a matter of fact, uric acid is but one abnormal product found in these cases, and its exact part in causing these symptoms which accompany it is somewhat uncertain.

The preventive management of gout and lithemia are so similar that the two may be considered together. It must be both hygienic and dietetic. For those who have inherited a tendency to either, or have shown decided symptoms, there are three cardinal rules: live temperately, eat moderately, and abstain from alcohol. An open-air life, with abundance of exercise, is very helpful in overcoming inherent tendency. If a sedentary life must be adopted, the importance of exercise is particularly great, and it should be open-air exercise. The skin should be kept active, and this is best accomplished in the cool morning bath as directed elsewhere. If the reaction from this bath is not good, then the warm evening bath should be employed. Turkish baths are most useful for those of the gouty temperament. The clothing should be warm, but not so warm as to cause over-heating. Flannel should always be worn, but it may be of thin texture in summer. When we approach the subject of diet for those inclined to

gout and lithemia, we encounter difficulties, for practitioners differ considerably in their views. The personal element is here of special importance and largely accounts for diverging opinions. "Nowhere is it more necessary than in gout," says Sir William Roberts, "to consider the man as well as the ailment." It is certainly true that the diet adapted to one gouty or lithemic man is not always adapted to another. When the hereditary tendency is strong the symptoms will sometimes appear and throw discredit upon any form of treatment and diet. When the tendency is slight, the mere reduction of the quantity of aliment is sometimes sufficient.

The old belief that all nitrogenous food should be prohibited is not now generally accepted. In this class of food is included meat of all kinds, game, fish, and eggs. The weight of opinion now leads to the use of a modified nitrogenous diet, without excess in starchy or saccharine articles of food. Lithemia is not due to an excess of nitrogen alone, but to numerous other factors. The lithemic patient, according to Doctor A. H. Smith, is like a spendthrift, who cannot be cured by keeping money from him. He must be educated to better habits. As the spendthrift will pawn his clothes to get money, so the system will pawn the tissues,

so to speak, to obtain nitrogen. It is not necessary to wholly withhold nitrogenous food. A diet should be selected, after study of each case, which will be readily digested and assimilated. An excess of starch, fat, and sugar should be avoided, as by their fermentation they produce acids which aggravate the disease. Fats, if they are properly digested, need not be wholly prohibited. It is better to give moderately of dark meat, according to Yeo, one of the best English authorities, rather than to burden the digestive organs with an excess of white meat and other foods used to take its place. Green vegetables, fresh fruits, fish, eggs, toasted bread, and soups or meats or vegetables, are especially appropriate articles in these cases. Whether milk should be used depends largely upon the conditions of the individual case. It should not be used if it causes constipation or the so-called bilious conditions. Water should be given freely, especially alkaline mineral waters like Vichy and lithia water. Hot water before breakfast and cold water between meals is very helpful. The important point in the dietetic management is to secure a wholesome mixed diet, which will be readily digested and assimilated by the patient for whom it was designed. It should include a little meat and other nitrogenous food, while the sweet

and starchy elements should not be in excess. In addition to restricted diet, the gouty and lithemic require an exceptionally liberal amount of exercise. This cannot be too strongly insisted upon.

Mineral water is beneficial chiefly because of the water itself. Among the resorts best suited for gout and lithemia are Saratoga and the Virginia Hot Springs in the United States; Bath and Buxton in England; Aix-les-Bains and Contrexéville in France; Carlsbad and Homburg in Germany. It is certain that these various mineral waters are efficacious more because of the amount of water taken into the system than from their chemical properties. At these various resorts the waters are taken in large quantities on an empty stomach. In addition to this are the very important elements of prescribed diet and exercise, freedom from care, regular hours, and baths properly administered.

There are mineral springs in this country equal in medicinal value to any in the Old World, but they are under no adequate supervision, and lack the many concomitants which render such places as Carlsbad, Homburg and Contrexéville so efficacious. Moreover, people are slow to take advantage of the aid that is available in American resorts. Those who would not think of going to a Continental resort without seeking medical

advice, consider themselves perfectly capable of selecting an American watering place and advising themselves as to what to do when they get there. It is not strange that American health resorts yield less favourable results than do the European.

DISEASES OF THE LIVER

The diseases of the liver requiring consideration here are but three in number: cirrhosis, gallstones, and fatty liver.

Cirrhosis.—This disease, sometimes known as "gin-drinker's liver," consists of contraction and hardening of the liver, with consequent obliteration of the secreting cells. It occurs chiefly in middle-aged men, being about four times as common in them as in women. When once established it is incurable. It may result from several causes, but the excessive use of distilled spirits produces many more cases than do all the others combined. As the sweet wines and fermented liquors cause gout, so spirits cause cirrhosis. Alcohol is absorbed from the stomach and expends its first force upon the liver. If taken into an empty stomach its absorption is very rapid, and it enters the liver undiluted. The early morning dram of the confirmed toper is deadly in its results. When a man finds that he must have this morning dram, he may write himself down an inebriate

(polite name for drunkard), whether he ever gets drunk or not. In the great majority of cases cirrhosis of the liver may be avoided by the living of a sober and respectable life.

Gall-Stones.—These occur in women three times as often as in men, and are most common between thirty and sixty. They more frequently occur in stout than in thin subjects, and in those who lead a quiet or sedentary life. The use of sweet and starchy foods predisposes to them. The conditions described on previous pages as causing lithemia are also active in causing gall-stones. Tight-lacing is an undoubted cause, as it checks the flow of the bile. Mental depression, constipation, and dyspepsia are regarded as predisposing causes. The measures for the prevention of gall-stones are virtually the same as those advised for lithemia.

Fatty Degeneration.—The causes of this condition are the same as those which result in the fatty degeneration of other organs. The subject is considered in the following section, and in chapters on the sedentary life and obesity.

FATTY DEGENERATION

Fatty degeneration is considered in many of its details in the chapters on the sedentary life and obesity. It is not simply an accumulation of fat about an organ or within it, but it is the conversion

of the substance of the cells themselves into fat. The result is the impairment of the function of the organ involved, for its cells are destroyed. The organs most frequently involved are the arteries, heart, liver, and kidneys. In middle life fatty degeneration results chiefly from too much aliment, especially of the starchy and saccharine class; too much alcoholic drink, especially sweet wines and fermented liquors; and too little exercise. It may be caused at any age by phosphorus and arsenic poisoning, and may follow diphtheria and other infections and other wasting diseases.

As I had occasion in several places to point out the deleterious effects of alcohol when taken in health, it is but right to make a brief statement regarding its use in disease. The great majority of medical practitioners agree in believing that there are certain acute diseases, like diphtheria, pneumonia, and typhoid fever, in which judicious alcoholic stimulation is sometimes of the greatest value. No physician believes that every case should receive stimulants. They are indicated only in certain conditions and at certain stages. Their use requires as much judgment as does the use of opium or nux vomica. Because these drugs are capable of doing great harm if taken indiscriminately in health, it is not a true corollary

that they should never be prescribed in acute illness. It is true that there are a few physicians who never prescribe alcohol, and there is certainly a growing tendency in the profession toward restricting its use, but there are very few experienced practitioners to-day who are willing to be wholly deprived of its aid in certain emergencies and crises. It is my personal belief, reached after years of conscientious observation, that in health alcohol is never necessary and is often a curse; but judiciously prescribed in disease it may be a great blessing and a means of saving life.

HEART DISEASE

The heart is subject to many forms of disease, some being common to early life, others to middle age. Disease of the valves may occur at any age. It usually results from inflammation caused by the poison of some infectious disease. It sometimes complicates scarlet fever and diphtheria, but rheumatism causes more valvular heart disease than do all other causes combined. This is not true of chronic or muscular rheumatism, but only of the acute inflammatory disease. Such rheumatism is especially liable to involve the heart in children. In many cases the heart accommodates itself to the valvular weakness for many years, and

in others never causes any trouble. Most of the valvular disease of later life dates back to some rheumatic attack in early years. In children, rheumatism is such a mild disease that it is sometimes hardly recognized or is forgotten, but the mildest attack may affect the heart. Inflammation of the pericardium, the covering membrane of the heart, is not uncommon, and is due to much the same causes as inflammation of the interior of the organ. There is virtually but one way of preventing valvular heart disease, and that is to prevent rheumatism, a subject which is considered in another place.

Disease of the heart muscle is not infrequent in middle and later life. Fatty degeneration is most common, but there are other forms of degeneration. These conditions are often very difficult of diagnosis, for in many cases they present no characteristic symptoms. They may result, however, in sudden failure of heart power upon excessive or abrupt exertion. Some cases of sudden death are due to this cause. Gout and extreme lithemia have also an effect upon the heart. In such cases unexpected heart failure may occur during the course of acute disease. The poison of diphtheria in some cases causes a grave form of degeneration of the heart muscle, so that death sometimes

results suddenly after the throat symptoms have disappeared. The importance of prolonged rest in such cases cannot be too strongly insisted upon. There are certain arteries which supply the heart itself with blood. In arterial disease, these heart arteries suffer, and their rupture or obstruction is a cause of sudden death. These various degenerative changes of the heart are due to the same causes which produce such changes in other organs, and their prevention is considered in other places.

DIABETES

Diabetes is a constitutional disease in which sugar accumulates in the blood and is excreted in the urine. It is not a disease of the kidneys, as it is frequently believed. The kidneys act only in removing the sugar from the blood, as they do other foreign substances. It is much less common in this country than in Europe. It occurs with particular frequency in Paris. While it cannot be called rare, it is not one of the common diseases. Although no age is wholly exempt, it is most frequent between fifty and sixty. Men are more often affected than women.

Heredity is a factor in its causation, as might be expected from its frequent association with gout. Worry and mental shock are among the more prominent causes. High tension and intense

methods of doing business, combined with a sedentary life, are apparently capable of producing it. In some cases, the same causes which produce gout seem capable of producing diabetes. In very many cases marked obesity precedes the onset of the diabetes, and seems to have a causative relation to it. Whether the obesity itself be the cause, or whether the two conditions be produced by a common cause, is not certain. Injuries to the head and spine have been known to be the immediate cause in numerous cases. In the young, diabetes is much more rapid and fatal than it is after forty. After that age it is slow in its progress, and is sometimes present for years. If the sugar disappears on a diet free from sugar and starch, the outlook for complete relief is most favourable.

It is evident that diabetes is not as readily preventable as some of the diseases that have been described. Still much may be done to obviate its occurrence. When there is any suspicion of tendency to it, hereditary or otherwise, the use of sweet and starchy food should be restricted, and the precautions advised for the prevention of gout should be observed. Obesity after middle life should be prevented as far as it is possible. Sources of unnecessary worry should be avoided. The

surface of the body should be protected from exposure by the use of flannels, and the skin should be stimulated by cool bathing. Turkish baths are distinctly useful as a preventive. Exercise is important, and an occupation should be selected if possible which does not involve sedentary living. When the disease has manifested itself, sugar and starches should be eliminated from the diet, but the details of management must be especially arranged for each case. Here, again, the personal element is very strong. It is the patient who requires treatment even more than the disease.

OBESITY

After forty, there is apt to be a change in physique, either toward spareness or stoutness. Individuals of the former type are as a rule the healthier, and enjoy a longer lease of life. There are two well-recognized types of obesity, the plethoric and the anemic. The former is more commonly seen among men, and is a condition of overnutrition. If excessive, it may be followed by arterial degenerations and kidney trouble. In many cases the excess of fat seems but slightly detrimental, and does not interfere with activity. The anemic type is more often found in women, but is by no means confined to them. There is paleness, and

often shortness of breath upon exertion. The appetite is usually small, and the tendency to overeat is not as common as in the plethoric type. There is prone to be an aversion to meat, but the love of sugar, candy, and sweets is sometimes inordinate. In the woman of this type irregularities are the rule, and nervous disorders are common.

Tendency to obesity is hereditary in more than 50 per cent. of cases. When the tendency is strong, prevention is always difficult and often impossible. Classified according to its causes, there are two types of obesity. The one is due largely to overeating, overdrinking, and lack of exercise. The other occurs in small eaters who drink no alcohol. It may persist on the most meager diet, and cannot be entirely removed by any means at our command. There is no form of corpulence, however, which cannot be relieved somewhat by proper diet and exercise, and in many persons it can be prevented entirely.

The methods adopted for reducing corpulence are usually exhibitions of zeal without knowledge. Stoutness is a permanent condition, and cannot be overcome by spasmodic and intermittent efforts. The rational plan is to adopt measures that can be used continuously. The "cures"

usually resorted to are so radical and extreme that no one can or ever does persevere in them. The weight must be reduced so many pounds a week or the cure is considered a failure. The "specialists" who reduce corpulence are bound to produce a striking result or their trade will fall off. Having accomplished that result, they leave the patient to continue it, and the fault is placed on him if he does not do so. The ability of the specialist has been demonstrated. But the methods are such that no rational person will persist in them indefinitely. Nine out of ten become desperate, and not only give up all effort, but do reckless things, and the relapse is more rapid than the cure.

I have no *cure* for obesity to propose. It would not be within the scope of this work, even if such a plan were desirable. In extreme corpulence, when rapid reduction is indicated, the necessary measures should be adapted to the case by a competent physician. This chapter is designed to offer some advice to those who become stout at middle life but not excessively obese. To secure a permanent result, it is the most sensible plan to adopt measures of living which can be adhered to and made the permanent mode of life. When a decided reduction seems desirable, that method is best which acts slowly and steadily. Such a

method sometimes shows no apparent result for the first two or three weeks, but after that time a steady but not excessive reduction of weight occurs.

To determine the best mode of life for this purpose, we may learn something from the means adopted for rapid reduction. The various cures in vogue are modifications of three systems, those of Banting, Oertel, and Ebstein. Banting was a fat undertaker whose weight was reduced thirty-five pounds by his physician, William Harvey. He was so much pleased that he wrote a letter in 1863, "addressed to the public," describing his experience, and inadvertently getting his name attached to the method. This system permits plenty of meat and alcoholic drink, reduces the starch and sugar moderately, almost completely forbids fat, and places no limit on water. It is unsatisfactory in principle and practice. The brain and nerves normally contain more fat than any other tissues of the body, and its absence from the food for long periods is injurious. We know to-day that fat is far less a fat producer than are sugar, starch, and alcohol. Banting's method, if persisted in, is capable of doing serious harm. It was upon this method that the so-called Salisbury cure was based.

The main feature of the Oertel method is the large reduction of fluids. Sugar and starch are allowed more freely than in the Banting method, and much more fat. The Ebstein method cuts down the meat and greatly reduces the sugar and starch, but gives fat very freely. Weir Mitchell advises the stopping of all food and drink except milk and eggs. Of them he gives one egg and eight ounces of milk every three hours for three weeks. The dietary is then slowly enlarged, but is markedly restricted. This affords a simple and usually effective method of beginning reduction.

Strange to say, each of these radically different systems is effective in largely and rapidly reducing fat. The reason is not far to seek. They effect their result through wasting of the body by virtual starvation. The Banting system cuts down the nutrition value of the food to one-third that of the "normal average diet," and the other two systems to about one-half. The success of these systems shows that the prevention of corpulence does not depend so much upon the reduction of a special food as upon a reduction of all the food taken. Hence, the first important rule is the avoidance of overeating. Most methods of rapid reduction place the amount of food too low to be safe for prolonged use. It should not be supposed

that a judicious selection of food elements may not be made to advantage. The sugars and starches should be decidedly diminished, and the fat should also be reduced, but the albuminoid foods may be taken freely. If the person is a large water drinker, as many stout people are, the amount of fluid should also be diminished. But here we are often confronted with a dilemma. A diet liberal in meat and eggs, with a small amount of water, is indicated, on the one hand, for the relief of the corpulence. But on the other hand, such a diet predisposes some individuals to uric acid and irritation of the kidneys. Hence, most sensible systems do not crowd the meat too far, nor restrict the water too much. As a rule, water should be drunk freely between meals. It should bear some relation to the amount of meat and eggs eaten; the more the meat, the more the water.

To summarize, we may say that the diet at middle life, when there is a tendency to stoutness, should be in general harmony with the following outline, it being understood that it must be modified according to the peculiar tendencies of each individual:

Exclude entirely fermented liquors, sweet wines, puddings, pastry, and rich desserts.

Take in very limited quantity sugar (enough

to make the food palatable), potatoes, the starchy vegetables which grow underground, thick soups, and milk.

Take in small quantities farinaceous and starchy foods, cereals, bread (best in form of thin toast), and clear soups.

The following may be taken more freely, but still in moderation: Meat of all kinds once a day, eggs once a day, fat—especially in the form of butter.

Still more freely may be taken green vegetables, salads, fruits, fresh fish, and fowl. These should be made an important part of the diet, especially in summer.

Tea may be used, but coffee and chocolate should be restricted, but not necessarily excluded. Tobacco should be used with great moderation. Little fluid should be taken with the meals, but water may be taken between meals as already specified. Milk should be taken sparingly, unless it is used alone as a special mode of diet.

It should be fully understood that exercise is as important as food in keeping down flesh. For this particular purpose walking is of especial value. Golf, which involves so much muscular activity, in addition to walking, is one of the most effective fat-reducing exercises known. Tennis and all

outdoor sports are also serviceable. Daily exercise on foot is a necessary part of every system.

CANCER

The increase in the occurrence of cancer is one of the most noteworthy features of disease of recent times. It is widespread, and is not confined to a single country. In England, the occurrence per million of inhabitants during the past four decades has been respectively 384, 468, 598, and 829. An increase is shown in Germany and Russia, while in Switzerland it has been particularly marked. In the Netherlands, in twenty-four years, there has been an increase in cancer of eighty per cent. An increase is shown in almost every State of the American Union. The United States census shows that in 1850 there was one death from cancer to 156 from other causes. This ratio increased in each report until in 1900 it was one to thirty-five. These changes are not quite as great as they may seem. With increase in medical knowledge and diagnostic skill, many cases are now discovered which would not have been recognized fifty years ago. This is especially true of internal cancers, which form a large percentage of the whole number. It is these, in fact, which have shown the most decided increase. But making every allowance upon such grounds, the

fact remains that there has been a great increase in the frequency of this disease.

To few other diseases has more earnest study been given. A vast amount of knowledge has been accumulated, and yet there are few diseases upon which so little can be said regarding actual causation. Innumerable theories have been proposed, but have one and all been found wanting. One of the more recent theories attributes the disease to the increased amount of meat consumed. Reiche, of Hamburg, has recently shown, however, that it occurs as often in the poor and ill-fed parts of the town as in the rich and prosperous. It prevails in European countries where very little meat is eaten. This is an example of the many theories which have been disproved upon investigation. The theory that the disease is produced by certain parasites has been strongly held, but lacks confirmation. The very recent report of the cancer committee of the Harvard Medical School, while it does not completely disprove this theory, throws the gravest doubts upon it. The bacterial origin of cancer, which has also been urged, has not received confirmation. At present it seems more probable that the origin of the disease will be discovered by the aid of physiological and pathological chemistry. Much is known of the pathology

of cancer—that is, of its physical nature and method of growth. It has been called a condition of cell anarchy, or cell revolution. It consists of over-active and wrong methods of growth of the cells. These are well understood. It is not the method of diseased growth regarding which we are still in the dark, but the agency which starts it into action. Prolonged or often-repeated irritation of a part, particularly if it has been the seat of injury or inflammation, is a predisposing cause, and possibly an exciting cause. Hence lacerations and old sores show more tendency than does normal tissue to be affected. While few of them ever become cancerous, still their proper treatment is one of the means of preventing such a result.

It will be seen that, with our present knowledge, no positive rules can be given for the prevention of cancer. The observance of the following rule, however, will do much to reduce its mortality: No abnormal growth in any part of the body should ever be regarded as unimportant. The best medical advice available should be sought early. The patient need not be alarmed if the doctor should call it a tumour. People often suppose that a tumour and cancer are the same. The surgeon calls every growth a tumour, but only a

small proportion of the tumours he sees are cancerous. Tumours are of two classes, benign and malignant. The former are much the more common, and comprise swollen glands, fatty, fibroid, and many other tumours. The term "cancer" is a popular name which covers several forms of disease. On the one extreme is the very grave condition known as hard cancer; on the other are several forms of growth on the border line between the benign and malignant. The one tends to recur even when removed early. The other, if left in the body, is prone to take on a malignant character, but if removed shows no tendency to recur. Between these extremes are other forms, malignant and capable of doing serious harm if not removed, and showing but slight tendency to recur.

The semi-malignant tumours often look as bad as the malignant ones do in their early stages. It is upon these semi-malignant growths that the cancer curers flourish. Their cures are effected upon the growths which have but little tendency to recur. They make a strong point of curing without operation. When their work is effective, they mostly employ caustics, usually in the form of a paste. The celebrated Vienna paste, for example, consists of equal parts of caustic potash

and quicklime moistened with alcohol. Many a deluded sufferer has endured the most dreadful pain for days rather than undergo an operation. There is not a paste, or caustic, or method of treatment in use, which is not known to surgeons. Most of them, in fact, have been stolen from regular practitioners. While I was on the staff of the Skin and Cancer Hospital, extended observations were made upon the use of these various pastes. Some of them do excellent work in superficial growths and mild conditions. The cases are limited, however, in which they constitute the best treatment. In many cases they are futile if the growth is malignant. It is simply silly to say that "surgeons operate because they like to use the knife." That expression, "the knife," is one of the most effective weapons of the quack. Surgeons use pastes and similar methods in some cases of cancer, but they operate in most cases, because in that way they get the best results. From the standpoint of the patient, the best results are very desirable results to secure.

Early removal will save many lives, even when the growth is of the more serious types. Delay is dangerous. There is no form of internal medication which will check the growth of true cancer. This statement cannot be made in a too positive

manner. Temporizing with such things as clover tea or sarsaparilla is taking desperate chances. If the disease be a true malignant one, it will go on and in time involve the neighbouring glands, and finally, when operation is decided upon, it will be too late. Conservatism is a quality of the highest value in medical and surgical practice. There are many places in which it is the course of wisdom to watch and await developments. There are other places where true conservatism leads to prompt action and where rashness consists in delay. This is true in the case of malignant growths, or of those whose character cannot be certainly determined but is open to reasonable suspicion.

Increasing experience is adding to the belief that in the Roentgen ray we have a potent agent for the treatment of cancer, but there is no evidence yet at hand to prove it a cure-all. It should not be employed to the exclusion of operation in operable cases. In the most recent expert article on the treatment of cancer at the time of this writing, the conclusion is drawn that the best interest of the patient is served by early diagnosis, early radical removal by surgical methods, and subsequent treatment of the infected area by the Roentgen method.

CONSTIPATION

This troublesome disorder is not limited to middle life, though it is especially common at that time. It is considered here, however, as no other place seems more suitable. It is a cause of many ills from which all sorts and conditions of people suffer, and its removal is prerequisite to their cure. Dyspepsia and indigestion in all its forms can rarely be rectified as long as constipation exists. All the diseases considered in this chapter are aggravated by it, and nearly every condition of ill health is made worse by its presence. A large number of proprietary and patent medicines derive whatever beneficial influence they possess from the fact that they are laxative in their action.

The causes of constipation are very numerous, and the subject is a complicated and difficult one. I have in my library a quarto volume of 500 pages wholly devoted to constipation in children and adults. It is by no means the simple matter that the makers of liver pills would lead one to believe. The first cause to be considered is constitutional proclivity, either inherited or inherent, and is characteristic of some families. It may be due to weakness of the muscles or other organic defects; often the result of some gastro-intestinal disease of early life. In such cases prevention is always

difficult, and there are some which cannot be overcome by diet and exercise alone. The sedentary life is another important cause of constipation, and it is necessary for most of those who live such lives to take measures against it, the chief of which are diet and exercise. Improper diet is a potent cause, and is commonly associated with most of the other causes. A diet consisting of concentrated foods, like meat, eggs, and milk, is constipating. These foods, being largely digested in the stomach, are soon absorbed, and leave but little residue. Astringent articles, like tea, claret, and brandy, check bowel action. Habitually small eaters are often of constipated habit, and the same is sometimes true of those who overeat of coarse and indigestible food. Irregularity of eating, and great variations in the amount of food taken, by deranging digestion, tend to produce constipation. A fourth important cause is insufficient fluid. Occasionally the free drinking of water will produce a brilliant result in relieving constipation, but the number of such cases is not large. It will usually, however, be an aid to other measures. Irregularity of habits and neglect of the calls of nature cause much constipation. So important is regularity that other means are, as a rule, ineffective if the habit is not formed of

attempting to relieve the bowels every day at the same hour. The habitual use of medicine is a bad habit, and the cause of the very condition it is designed to relieve. Constipation is a common accompaniment of certain diseases of the liver and stomach, and also of anemia and all forms of prostration and reduced physical strength.

Constipation so commonly accompanies other conditions that diet can rarely be prescribed for it without also considering them. In general terms the diet should contain but a small proportion of meat and other concentrated forms of food, but should consist of fruit, vegetables, and cereals. As in arranging a diet for obesity, one should be adopted that can be adhered to. A tendency to constipation is continuous and persistent, and must be met by continuous and persistent measures. Two errors are common. The first is reliance on a single measure—a single article of diet, a single mechanical measure, or a single drug. No one of these is in itself sufficient if the case is obstinate. The diet must be corrected, and the attack must be made from several points at once. The second error is the attempt to correct a continuous and persistent condition by intermittent and spasmodic management.

The following are among the laxative articles of food, and are suitable for the constipated. It must be understood that the eating of one or two of them will not overcome the trouble. The diet must usually be wholly remodeled and made to contain a large proportion of the following articles: Green vegetables and salads of all kinds; cereals, especially oatmeal, hominy, and farina; bread made of cornmeal, whole wheat, or Graham flour; raw fruits, especially oranges, figs, prunes, apples, peaches, berries, and grapes; cooked fruits, especially baked apples and stewed prunes; light soups and broths; fish of most kinds simply cooked, and fish preserved in oil; poultry and game in moderation; sugar, honey, and molasses, care being taken not to take enough to disturb the digestion; butter and olive oil. The following articles should be taken sparingly, but it is rarely necessary to prohibit them entirely: eggs (especially hard boiled), meat, salt fish, liver, milk, cheese, nuts, peas, beans, rice, wheat foods, strong tea, and sour wines.

The exercise best adapted to those of constipated tendency is walking, or playing golf or tennis. Certain exercises designed to strengthen the muscles of the abdomen are also useful. Rubbing or kneading the abdomen is a helpful measure, while massage is very efficacious when the tendency is

strong. In that case, the trouble can only be prevented by the systematic and persistent use of all the measures available—diet, exercise, local measures, and regular habits.

CHAPTER XVII

The Sedentary Life

It has been said that the present generation is the first in all history that has been sedentary. Certain it is that the sedentary class has increased during the past quarter of a century to a vast army. By a strict definition, the term applies to those who sit at their work. The conditions of modern business, however, require many workers to stand, but in so limited an area that they may be classed without impropriety as sedentary workers. There are present the important factors of indoor life, more or less imperfect heating, lighting, and ventilation, and lack of effective exercise. The only difference is that of bodily position, the exercise of the one who stands being but little more than that of the one who sits.

Upon no other individual does our modern civilization place so heavy a burden as upon him who leads the sedentary life. It is the life farthest removed from the normal. Those who have been reared into it acquire at the same time habits of

life more or less adapted to the condition. It is those who come suddenly into it who are the worst sufferers. They rarely adapt themselves to the new conditions by a change of habits. The country boys who come into the cities in such numbers have led a life diametrically opposite to the one they are entering. Even if they have been reared in a village or small city, they have lived a life of comparative quiet, and have spent much of their time in the open air. They come into noise and excitement, live in small rooms in crowded localities, eat more meat than they were accustomed to before, and spend their hours of labour in close rooms, and get little bodily exercise. It is not strange that there are so many failures and breakdowns and smash-ups among young men of this class. If they are sturdy and vigorous, they can tolerate the life sedentary with overfeeding and lack of exercise. They are particularly liable to suffer from its results, however, in later life. The error of overeating is more frequent among sedentary workers than among any other class of people.

The results of overfeeding, combined with the sedentary life, are admirably illustrated by the goose of Strasburg. This bird is kept in a close, warm place, without the possibility of exercise, and

is forcibly fed on enormous quantities of nourishing diet, chiefly milk and barley. It rapidly becomes corpulent and heavy. Its liver becomes larger and larger, and finally attains a state of fatty degeneration which renders it available for that luxury of luxuries, *pâté de foie gras*. We thus have in the goose of Strasburg the most perfect type of the sedentary liver. But as Thompson aptly remarks, we do not have to go to Strasburg to see excellent examples of the same type. We constantly see those who spend their lives in close, warm places, with little exercise, putting into their stomachs enormous and unnecessary quantities of fat-producing aliment. Fatty degenerations, not of the liver alone, but of the heart and various tissues of the body, are becoming more common. This form of disease is one of the few that has increased during the past two decades. It is due largely to three causes: increase in the number of sedentary workers, failure to modify the habits when such a life is adopted, and the drinking of malt liquors. Large numbers of these workers take the food adapted to the manual labourer. They eat too much meat, drink too much beer and coffee, and use too much tobacco.

As explained in the chapter on regimen, the assimilation of the food to the uses of the body

after it has passed from the digestive organs is of vital importance. Certain food may be improper for an individual, even if he digests it perfectly, for he may not be able to assimilate it. "His food does him no good," is a common expression. Muscular action is necessary for the assimilation of some kinds of food. It is manifestly absurd, therefore, for those who take little exercise to consume large quantities of such food. A popular method of describing this form of non-assimilation is to say that a food is "clogging" or "bilious." Meat and beer are two elements to which these terms are particularly applicable. Coffee, as before described, checks tissue activity, precisely the thing that exercise is designed to increase. The same is to a certain extent the action of tobacco. If exercise is a part of the daily life, then a food may be taken which will support muscular activity, and a drink, perhaps, which will check tissue waste. But why put such food into the body and then consume valuable time in exercising it out? A certain amount of exercise is necessary to keep the muscles and organs in proper condition. We cannot avoid taking some food that demands muscular activity for assimilation and elimination, but a man who finds it necessary to take an excessive amount of exercise in order to keep himself

in reasonable condition may be certain that there is something wrong with his diet.

It is a fundamental proposition that the "intake" should bear some relation to the "outgo." If the outgo has to be forced too vigorously, in the absence of diseased organs, it indicates that the intake is too large. Is it not wiser to reduce the intake rather than expend so much time and labour in increasing the outgo? This has been written under the supposition that the individual sees to it that the outgo is kept at par with the intake by means of vigorous exercise. But suppose he does not do this? What happens when the intake is allowed to become comparatively excessive? It requires no physician to answer. Something must clog up. Sometimes the first effect is felt by the digestive organs, and the individual becomes thin, irritable, and dyspeptic. In other cases, fat is stored up, and the person becomes corpulent. In others, the liver becomes sluggish and fatty. The kidneys are irritated in attempting to do too much work in eliminating the excessive waste products. The individual has "bilious attacks," uric acid or gouty attacks, sick headaches, migraine, muscular rheumatism, or any one of a score of other symptoms. He becomes heavy and lazy, and feels that he is capable of less mental exertion.

There are two requisites for such a case. Unless they are fulfilled, no treatment will avail to give permanent relief. These are less food and more exercise. Exercise is the only way of getting rid of the "unspent food which saturates the system."

It should be understood that the preceding remarks apply but partially to that type which naturally tends to become very stout. Many individuals acquire fat on the most meager diet. On an improper diet it will accumulate almost without limit. In such cases the fat is laid on the body and between the organs, being in a certain sense superficial. Strict dieting and active exercise will readily reduce it. There is often no tendency to fatty degeneration of the organs, which is a deep-seated process, in which the elements composing the organs become degenerated and infiltrated with fat. It is largely the result of vicious diet and habits, and when it has occurred can be but partially relieved. Stoutness does not necessarily mean fatty degeneration.

There is, on the other extreme, a certain thin type which never accumulates fat. Attempts to increase the weight by diet, change of air, or exercise will add a few pounds, after which no effort will add another ounce. In the first type mentioned there is an unnecessarily large amount

of reserve material. While it is often burdensome, the individual may be free in action and perfectly clear of head, unlike the one who becomes corpulent from bad diet and is liable to fatty degenerations. The thin type, often known as the motive temperament, is frequently all muscle and capable of enormous labour. There is lack, however, of reserve material, and such an individual must be fed regularly or the motive power fails. This type is inclined to tolerate the sedentary life better than does the obese type.

In returning more explicity to the subject of diet, consider the differences in the life of the manual labourer and the sedentary worker. For at least eight hours each day the first is engaged in vigorous physical exercise, usually in the open air. He swings a sledge, uses a shovel, or carries heavy weights. Another class of manual labourers may work less vigorously, but the worker is not idle for hours together. The sedentary worker sits at a desk or a machine within doors or moves about an office. He gets his luncheon in the same building, or walks a few blocks for it, and morning and night he may take fifteen or twenty minutes' "exercise" in his room. Altogether, he may be able to perform as much physical labour in a fortnight as an Italian labourer in the subway does in a

day. His aliment, however, may be depended upon to be about equal each day to that of the subway digger. It should, however, be different in quality and smaller in amount. It should be nourishing, and not mere milk and water. If much brain-work is done, the diet should be liberal, for such work uses up aliment as well as does muscular labour. "Cereal foods," says Thompson, "and well made bread in variety, and vegetable produce, including fruits, should form a fair portion of the diet, with the addition of eggs and milk and little of other animal food than fish, fowl, and game. On such a dietary, and without alcoholic stimulants, thousands of sedentary workers may enjoy with very little exercise far better health and more strength than at present they experience on meat and heavy puddings, beer, baker's bread, and cheese. Of course, there are workers whose habits cannot be strictly described as sedentary, who occupy a middle place. For such, some corresponding modification of the dietary is naturally appropriate."

Such a diet may be made very palatable. It may not be well relished at first by one who has made meat the principal element of his dietary. Much meat-eating spoils one for less highly flavoured diet, but after a little persistence it will be found

that the appetite will be better than it was when so much meat was taken. It should not be understood that the complete disuse of meat is here advised. It may be taken by most people to advantage once a day. It is often better to take a small amount twice a day rather than too much at one meal.

No one dietary is adapted to all sedentary workers. What is suited to one may not be to another, for people of every temperament and tendency are living the sedentary life. Something besides the mode of life must also be considered. The fundamental principle is, that the sedentary worker should largely reduce the amount of albuminoid or nitrogenous food, of which meat is the chief representative, fats, sugar, coffee, and malt liquors. It is rarely best to wholly eliminate any of them from the diet except beer.

A second important principle is, that the amount of aliment taken should not be excessive. Among the cereals, grains, breads, fruits, vegetables, green vegetables, salads, nuts, fish, shell-fish, fowls, vegetable oils, butter, milk, cream, eggs, and the combinations that can be made from them, there is certainly material for the making of a generous, nutritious, and palatable diet. Out of this variety each one should select what his

particular taste calls for and what his own experience indicates.

For an admirable summary of this question of diet for the sedentary workers, let us again turn to George Cheyne: "I advise all gentlemen of a sedentary life to use as much Abstenance as possibly they can consistent with the Preservation of their Strength and Freedom of their Spirits, which ought to be done as soon as they find any Heaviness, Inquietudes, restless Nights, or Aversion to Application; either by lessening one-half of their usual Quantity of animal Food and strong Liquors until such time as they regain their wonted Freedom; or by living a due Time on vegetable Diet."

Adequate and proper exercise is of the utmost importance to those who live the sedentary life. It should be taken every day in approximately the same amount. One of the greatest errors is to suppose that sufficient exercise can be taken once or twice a week. A long bicycle ride on Saturday afternoons, or a "century run" on Sunday, with no riding during the week, is worse than no exercise. The person who is not exercising steadily is in no physical condition for such excessive efforts. It is such use of the bicycle which has helped to bring it into disrepute. Women and elderly men should be particularly careful

regarding such intermittent overexercise. It has been justly remarked that golf and the bicycle before middle age have reduced the incomes of medical men, and after middle age have increased them. This is because the exercise is too severe or is overdone.

It is an error to suppose that heavy and over-severe exercise is beneficial to those who are much confined to the house. No sedentary worker, by any exercise he can take outside his business hours, can keep all his muscles in the condition of those of the labourer who works ten hours a day. He ought not to expect to do the violent work, therefore, that the labourer does. It is not violent exercise that is needed, but often-repeated moderate exercise. It is an error, also, to think that great muscular development is desirable in a brain-worker. The two are incompatible, though one often sees a brilliant brain in a body naturally powerful. Doctor Holmes has cleverly likened great muscles to great sponges which suck up and make use of great quantities of blood, while the other organs are liable to suffer for the need of their share. Certain it is, that great brain power does not accompany, as a rule, enormously developed muscles.

Indoor exercise and gymnasium work have

their place, and an important one. It is a mistake, however, to rely upon such exercise alone. For a man whose business is in the house, nothing can take the place of outdoor exercise. For most inhabitants of large cities, golf, tennis, and horseback-riding are out of the question. Walking and bicycling are all that is available. It is a pity that the value of walking as an exercise is not better appreciated. It is so cheap, and always available. No special costume is required; there is no groom nor stable man to annoy; there are no fees to be paid; and it is so effective in quickening the circulation, working off superfluous aliment, and keeping the muscles in tone. It has the particular advantage that it can be distributed through the day, being superior in this regard to any game or other form of exercise. One may walk a little farther to take the car to business in the morning. He may walk a little farther to take his lunch, or take a little walk after. His day of sedentary work being passed, he may again go a few blocks farther for his car, and straighten out the curves from his legs and back. At night there is still more opportunity for this exercise, either after the evening meal or just before bedtime. This exercise has all been secured through the day with virtually no loss of time. Of all the forms of exer-

cise available for the average sedentary worker, walking is the most universally useful, and should not be neglected.

To make exercise a duty rather than a pleasure is another error often committed. That form of exercise that is most to the taste should be selected. It should not be taken up in the spirit of the martyr, but with thankfulness that muscles have been given to us, and free open air in which to exercise them. "Of all remedies for the nerves, enjoyment is the most powerful," says Richter. There is no relief for tired nerves like moderate rational exercise in which one can take pleasure.

Bathing should be a factor in the hygiene of those who live the sedentary life. The morning bath should be considered as important in the preparation for the day as the breakfast. It should be a cool bath, as cool or as cold as can be taken without chill. It should be followed by a good "reaction." By this is meant that, after the bath, followed by a brisk friction of the surface with a towel, there should be a warmth and glow and feeling of invigoration. The temperature of this bath cannot be stated, for it must vary with different individuals. Some cannot take it to advantage below 60°. Others can learn to take

it at 50° and even 40°. In the summer the water may, as a rule, be used as it runs from the faucet. In New York the temperature is about 70°. Elderly people and delicate women and children should not take it as cool as this. It is one of the greatest errors to take a bath so cold that there is an excessive shock and a pinched and blue condition afterward. Such bathing will render a person thin in flesh, uncomfortable, and irritable. Many a child has been injured by too cold bathing, and many an adult has given up this health-giving measure because he used the water too cold and remained in it too long. Five minutes will undo all of the good for most people. A minute in a cold bath should be the limit. It is then a powerful stimulant to the circulation and nervous system. The skin takes on a healthy glow, and a feeling of well-being replaces the disinclination to begin the work of the day so common upon waking in the morning. It should be understood that the cool morning bath is taken as much for this reason as for cleanliness. The use of soap is advisable, for fortunately two valuable birds may be hit with one stone. There are very few individuals of ordinary health who cannot take to advantage a quick morning bath ranging somewhere between 60° and 80°. The aged and feeble should not

attempt it; the sedentary worker should not omit it.

For purposes of cleanliness a warm bath should be occasionally utilized, and is best taken at night. The temperature may range from 95° to 105°, and this bath may be continued for five minutes. The shower-bath can be taken to great advantage by the vigorous, but is too great a shock for many people, even those who can safely take a tub bath. Its introduction into modern bathrooms is much to be commended, but its use should not be abused. A hot foot-bath at night is often an effective remedy for insomnia. It is also an aid in overcoming the weariness and heaviness of head felt at night by brain-workers. It is best to take it just before retiring. The water may be as hot as can be endured (106° to 112°), and may be continued for ten minutes. This hot foot-bath at night is particularly useful for elderly people who sleep poorly and are subject to cold extremities.

The morning tub and shower bath are not within the reach of some, but there are very few to whom the sponge bath is not available. The cold sponge is almost equal to the tub. It may be utilized in case of necessity, and should be chosen by elderly people and those for whom the tub bath is too severe. The brisk sponging with cold water and

vigorous friction of the skin amply repay the time and trouble it costs. A secondary but by no means unimportant result obtained from all bathing is the immunity it confers against the liability to take cold. Sponging the neck and shoulders with cold water does much to ward off colds and catarrh, but general bathing does more. It is the most efficient of preventive measures against those visitations. When the cold bath is too severe, and is followed by imperfect reaction, cold sponging may sometimes be employed while the individual stands in a tub of water at about 100°. The water used for the sponging being at first 70°, may be slowly reduced until a temperature of 50° can be tolerated. This is an excellent way to give a cool bath to a child. It can be so tempered as to give no shock. It may also be employed by delicate persons. The temperature of both the tub and sponge water can gradually be reduced until, in many cases, an ordinary cold bath can be taken.

A final element of importance in the sedentary life is the surroundings in which the labour is done. The conditions to be desired are five in number: proper ventilation, proper heating, freedom from dust and dirt, freedom from unnecessary noise, and adequate light. They should always be sought

for, whether their full attainment be possible or not. The fact is of course recognized that there are many who must work in the surroundings furnished by others or give up their means of livelihood. There are others who might do something to improve their surroundings were they to give thought to the matter. There are many others who have the matter largely in their own hands. In cities, the dust and noise cannot be escaped, but they may usually be reduced, while the ventilation and methods of heating may often be improved. It is employers who can do most in this direction. It is a simple matter of business. They will get vastly more work out of employees placed in decent surroundings than from those working in unventilated, improperly heated, and dusty rooms with imperfect light.

When the surroundings in which the work is done are reasonably good, the sedentary life is not necessarily an unhealthful one. The one who must live it, by adapting his methods of living to his methods of work, by keeping out of ruts and taking some pleasure as he goes, may expect to attain a good old age with as much assurance as does the one who leads a more active life. He should not repine too much at his lot, nor should he regard himself unfortunate if he has much mental work

to do. Mental activity is not unhealthful; it is eminently advantageous. Mental workers are high up in the list of those who attain long life. The mental workers, living more or less strictly the sedentary life, are among those who are doing most to advance twentieth-century civilization. The position is one to be thankful for, not one to regret.

CHAPTER XVIII

AGE AND ITS ADVANCEMENT

AN old age, serene and bright, is a consummation hoped for by every well-ordered being. We are assured that we may rightly look forward to three-score years and ten, but then follows the sad assurance that, if by reason of strength they be fourscore years, yet is their strength labour and sorrow. This is not uttered as a malediction upon old age, nor even as a statement of the inevitable, but as a comment upon an often observed fact. While sorrows and troubles are no doubt more common during the declining years of life than during the dawning years, we may do much by wise living to prevent bodily afflictions and the sorrows which come from the infirmities of age.

Mere length of years is little to be desired. They are to be wished for only if they bring comfort to oneself and usefulness to others. The expression is sometimes heard that long life is not to be desired if it must be purchased by asceticism and abstinence from all the good things of life. There

is some warrant for such feelings. A life barren of all pleasure is certainly not so great a blessing that one would greatly desire to prolong it. But, fortunately, asceticism and barrenness of life are not synonymous with right living. On the contrary, right living is the most certain means within our own control of obtaining comfort and happiness. Do not make the error of thinking that those who urge methods of right living are preaching a puritanical life. The old puritanical life was not the best kind of a life to live, though it was infinitely better than the life it protested against. It violated some of the fundamental principles of hygiene and right living, and did even worse in putting a ban upon cheerfulness and innocent pleasure. It was too somber, and took a distorted view of life. Moderation and right methods of living do none of these things. They tend strongly, not alone to prolong life, but to render it comfortable and happy throughout its whole course, and to make old age "as a lusty winter, frosty but kindly." Wrong methods of living and dissipation do not always seem to shorten life materially, but sooner or later they almost infallibly render it uncomfortable, and make its last years miserable. If a man sow to the whirlwind, he will reap destruction.

Some excellent things regarding the diet and general management of those in advanced years have recently been written by Sir Henry Thompson, the well-known London physician. Always interested in diet and hygiene, he first wrote upon this particular phase of the subject when sixty-five years old, and now, a still vigorous man at eighty-two, he writes again. This work, the result of years of trained observation confirmed by actual experience, is so thoroughly excellent and unique that it has been largely drawn upon in the preparation of this chapter. Sir Henry holds strongly that diet should be diminished both in amount and strength in advanced life. He quotes from the writings of Luigi Cornaro, who was born of a noble family in Venice soon after the middle of the fifteenth century, and was contemporary for seventy years with Titian. He wrote his first essay on the subject of regimen and diet for the aged when he was eighty-three years old, producing three others during the subsequent twelve years. His object was to show that, with increasing age and diminishing powers, a corresponding decrease in the quantity of food must be made in order to preserve health. He died at Padua, "without any agony, sitting in an elbow-chair, being above an hundred years old."

The following outline of diet is given by Sir Henry: "I advise as a typical system which can be varied according to circumstances and personal idiosyncrasies of the individual, four small meals in the day. Following this course, the animal food supplied for breakfast and at lunch may include eggs or fish cooked in various well-known ways. At lunch, a little tender meat or fowl may be taken, unless it is preferred to reserve them for dinner, in which case fish and a farinaceous pudding may be substituted. This last-named meal should generally commence with a little good consommé; often substituting a vegetable *purée*, varying with the season, and made with a light meat stock or broth; or a good fish soup as a change. Then a little fowl or game and a dish of vegetable, according to the time of year. Finally, perhaps some light farinaceous pudding, with or without fruit, should close the meal, which is to be a light one in regard to quantity. Lastly supper: a very light refreshment may be advantageously taken the very last thing before entering bed, as it favours sleep. All animals feed before resting for the night. Few meals are more undesirable for a man than a heavy supper, which severely taxes digestion. But elderly men especially require some easily digested food to support them during

the long fast of the night. It is well known that the forces of the body are at their minimum at 4 or 5 A. M.; and this may be well provided for by taking about five or six ounces of consommé with one ounce of thin toasted bread at bedtime. Of bread eaten at meals, it may be said that, whether brown or white, it should be toasted; the white, as containing most starch, should be toasted thoroughly, so as to be quite brittle and show the brown colour extending through its interior; the starch is thus converted into glucose, which is soluble. Quantity during the meal, from three to five ounces of the bread before toasting it, which, of course, diminishes the weight. Fresh butter is the most generally wholesome of all fatty matters which come to the table; about three or four ounces may be taken daily.

"Very weak tea is generally the best at breakfast, with a good proportion of milk; and with sugar if it agrees. This is not to be taken very hot, and about five minutes after the conclusion of the meal. At lunch, the drink may include a breakfast cup of coffee with milk; or a draught, if desired, of pure distilled aerated water, either to be taken after the meal."

It is a common belief that light alcoholic stimulation is more suitable to advanced years

than to any other period of life. There is, no doubt, some truth in this. The reserve powers are far less abundant in later life than in earlier years, and the necessity for temporary aid in tiding over difficult places is correspondingly greater. Sir Henry Thompson found in his own case that the daily use of light wine at about seventy-five brought joint pains and sick headaches, which were undoubtedly gouty in their nature. Unless some such tendency is present, experience certainly shows that the judicious use of stimulants may add to the comfort of those of advanced years. On the days of weakness and depression which come so often to the aged, a little mild stimulant does much to render life more comfortable. There are times when they become feeble and trembling, when it may be properly given several times a day, always in very small amounts. The moral grounds which render unadvisable the giving of stimulants to younger people do not apply here. The doctor rarely, if ever, sees an inclination on the part of the aged to take too much. The opposite tendency is most common.

It is a great misfortune for the aged to have no occupation. The term "occupation" should be accepted in its full meaning—something that will occupy the mind as well as furnish physical exer-

cise for a portion of each day. This occupation must vary widely with different individuals. The man of seventy, active and vigorous, who is anxious to go to his business each day, had better be permitted to do so without too much opposition on the part of his friends. He should certainly shorten his hours and take liberal vacations. He should lighten his responsibilities and adjust his work so that it can be left for a few days at any time without causing him anxiety. He should never forget that he is seventy years old, no matter how young he may feel. On the day of this writing, Russell Sage is reported by the papers as having been in his office yesterday on his eighty-sixth birthday, engaged in his usual vocation of making short loans at high interest. Many men at that age are incapable of leaving the house. They should, however, have some occupation and gentle exercise. They should go into the open air daily as long as it is possible to do so. Being guided by his taste and previous habits and occupation in life, something should be found for each to do which will occupy a part of the time each day. This is a more difficult task for a man confined to the house than for a woman. Sewing, knitting, and partial care of her room, and many other things are available for her. The stockings

she knits or the silk quilt she makes are just as creditable to her as are the dollars which Russell Sage takes in. It is these white-haired, peaceful, though often feeble old people, with their calming and soothing influence, who bring most certainly to mind the words of Longfellow:

> "An old age serene and bright,
> And lovely as a Lapland night."

It is these, even though they have passed far beyond the average span of life, that the doctor finds are watched with the most tender solicitude, for the time never comes when they can be spared.

There are certain kinds of advice which it is unbecoming for younger people to give to their elders. There are one or two points of importance, however, upon which Sir Henry speaks most wisely. Being an octogenarian, he must be looked upon as one who speaks with authority. Another extended quotation may not, therefore, be inappropriate. "I cannot close my subject," he says, "without a remark or two respecting the supreme necessity in advancing years for firm determination to resist needless self-excitement from emotional causes of all kinds. If habits of self-command in respect to diet and exciting drinks have been steadily cultivated, it is probable that a due control of temper and of the passions,

and the avoidance of needless sources of worry or anxiety, should come to be regarded, not only as one of the main objects of life at this period, but also as an attainable one to a great extent—the first discipline having been useful in training the will to exercise restraint and self-denial. Each period of man's personal history brings its own appropriate duties and employments. By no means the least of those which accompany old age is a satisfactory sense of the absence of desire for pursuits, which there is now little inducement, or perhaps ability, to cultivate.

"Again, men's opinions are apt to become more or less fixed, as experience increases and habits of thought are formed. It is undesirable to assert these too strongly in the form of advice, much less to endeavour to impose them upon our children, whose ways are, naturally, not as our ways. Indeed, sound and wise as our advice to young people may be, great allowance must be made for the fact that they must, will, and even ought, within certain limits, to deal in their own way with the incidents they encounter in the early stages of life's journey, and learn by their own experience—as we ourselves did—paying, however, rather dearly for their lessons, perhaps."

It is a wise thing for some men to retire early

from business or professional life, and very unwise for others. It depends upon the character of the man. Some men stagnate. They become restless, irritable, and unhappy, and actually degenerate. This is apt to be true of "self-made" men. A man who took up his business in early manhood or actual boyhood, and has worked up to fortune and success, toiling in the one channel in season and out of season, year after year, giving no attention to other subjects, had better not leave that channel entirely, nor wander too far from it. In other words, he should not retire wholly until waning strength forces the issue. The lawyer or merchant who has studied, thought, and talked nothing but law or business, cannot safely retire when he has acquired a competence. He has no resources to fall back upon. He will become weary of existence, and die of dry rot. Had Russell Sage been obliged to retire at the age limit of the Army and Navy, he would probably have been in his grave years ago. A Carnegie, however, can "retire" with complete safety, as could a Weir Mitchell, an Oliver Wendell Holmes, and hundreds of other broad-gauge men. It is conceivable that the present President of the United States may retire from public life upon completing his term of office, but it is not conceivable that he

will stagnate or shorten his life thereby. He is what Holmes calls a three-story man, and gets light through more than one set of windows. If driven off the lower floor, he has abundance of room on the upper ones. One-story men, however, must retire to the garret, where they will waste away for the want of light and air. In this age of specialism it is a wise parent who endeavours to train his child to be an expert in some kind of work, but he should also see to it that in the building of character he has something more than a garret above the first floor. It is a comforting thing to have some mental resource to fall back upon when one wishes to retire from active labour, whether it be for a vacation in middle life, or permanently in later life.

Quite different from retiring from business or professional life is the question of resigning certain official positions as age advances. The business man and man of affairs holds numerous positions upon boards and directories or official positions in clubs or societies. The lawyer is apt to hold offices of semi-public nature. The physician holds positions in colleges and hospitals. Many such positions, while not lucrative, involve more or less labour and responsibility. They serve as useful aids to men in earlier life in getting

on in the world. In later life they have no such value, and yet they are often persistently held by men in advanced years. Some temperaments show a strong aversion to doing anything that may seem an acknowledgment that they are getting old. They find it almost impossible to give way to those who are younger, and are jealous of those who may succeed them. When they reach a certain age they lose the ability to comprehend when they become ineffective. A prominent surgeon recently said that when he became sixty-four he intended to resign his hospital and other similar positions, for he would never know enough to do so afterward. There is nothing more sad than to see a man impair a fine record or great reputation through not knowing when to stop. This, however, is but one reason for resigning extraneous and less important positions. As a man approaches later life, he ought to gradually lighten his burdens as far as he can. These positions, being of less vital importance, should be the first to be thrown off. He has little to gain from many of them, while they may be of considerable value to younger men. After he has held them, therefore, for years, and profited by them, it is only fair to give way to others. A source of unhappiness which one sometimes sees

in the aged is inability to thus give way to others and permit those who are younger to do things in their own way and according to their own ideas.

Men are not alone in this, for one often sees elderly women in churches and social organizations holding offices and doing work which younger women could do better, and would do if the opportunity were afforded. Every generation has its workers and individuals qualified to perform special tasks. Some one will appear to do the necessary work of the world, for there is no evidence to lead us to think that the rising generation will be less competent or less willing to work than is our own.

At no period in life is the *golden mean* more desirable than in old age. Idleness is conducive neither to happiness, health, nor longevity. It is to be shunned. Activity is healthful. "It is better to wear out than to rust out." But upon the other extreme, sudden and excessive exertion is to be guarded against. In old age the reserve power is slight, and certain organs are easily overtaxed. One who might go on for years doing ordinary work may give out suddenly under some unusual and excessive strain. Hence, unusual and excessive labour or gymnastic exercises should be avoided. Bicycling is often the cause

of injury to those who have passed middle life, because of the temptation to overdo, and to put sudden and excessive strains upon the heart, arteries, and lungs. Golf is also capable of doing similar injury. Among the exercises especially adapted to later life are walking and gardening. The latter, when it is available, is perhaps the most excellent form of physical exercise for an elderly man. The purchase of a place in the country, or of a small farm, is an admirable scheme for a well-to-do city worker of middle age. It will take his mind from the cares of business during the winter when he is laying his plans for the coming season, and will give him out-of-door exercise of the most healthful kind during the summer. Most men become deeply interested in such a place and the work connected with it. It furnishes an incentive to activity without over-stimulation and excitement. And the expense need not be large. In no other way can an elderly man so renew his youth and prolong his days.

The management of the aged in illness may properly receive a word of attention. The secret of successful management lies in maintaining the strength and conserving the vitality, for the hold on life is less firm than during the period of vigour of earlier years. This is accomplished by enforcing

quiet and by systematic feeding and stimulation. Concentrated nourishment should be given at short intervals. Beef juice, milk, broths, and eggs may be given every two or three hours. This is not a contradiction to advice regarding a light diet which was given in the early part of this chapter. The appetite is apt to be so small that sufficient is not taken to maintain the strength if the interval is too long. While avoiding the extreme of overloading the digestion or giving more than would be taken in health, this systematic feeding is very important.

The advice offered in this chapter may, perhaps, be enforced as well as summarized by referring again to our old friend, George Cheyne, who says, "Every wise Man after Fifty ought to begin to lessen the Quantity of his Aliment; and if he would continue free of Great and Dangerous Distempers, and preserve his Senses and Faculties clear to the last, he ought every seven Years to go on abating gradually and sensibly, and at last descend out of Life as he ascended into it, even into the Child's Diet."

CHAPTER XIX

Modern Surgery

"Surgery has virtually reached its limits," said Erichsen, the great English surgeon, barely twenty-five years ago. Such a statement lends force to the belief that the vocation of the modern prophet is one of great precariousness. At the time this statement was made, there was every evidence that it was well founded. The surgeon at that time was a master of anatomy and an expert in surgical technique. Under conditions as they then existed there was really but little prospect of material advancement.

But the conditions changed, and following hard upon that change came an advancement so great as to amount almost to revolution. It is not an exaggeration to say that were Sir Astley Cooper or Valentine Mott to return to-day to the scenes of their labours and triumphs they would not be permitted to operate in any hospital in the civilized world. Sir Astley hesitated to operate on George IV. for a wen, as he feared erysipelas, a serious

matter for a surgeon in so great a patient. At that time pus formation was expected after almost every operation, and the surgeon was happy if he escaped erysipelas or other forms of septic infection. If these things occur now the surgeon calls a sudden halt in his operating, and scrutinizes every detail not only of his own work, but that of his assistants and nurses. Formerly the surgeon was perfectly satisfied if the pus, which came as a matter of course, was smooth and light coloured. This he called "laudable pus." He began to worry only when the discharge became "ichorous" or "sanious."

The causes for the radical changes in surgical procedures and in the results attained are many, but two stand out so preëminently as to overshadow all the rest—anesthesia and antisepsis. The discovery of anesthesia was one of the great events, not only of surgical history, but of all history. Its results are not limited to the saving of pain, as is the popular belief. It is one of the great life-saving measures of modern times. Before anesthesia, the most rapid operator was the most successful surgeon; now it is the careful and painstaking operator. Then everything was sacrificed to rapidity; now rapidity is of minor importance. Painstaking care in every detail is the first essential. Few of the wonderful operations upon the abdomen

and the delicate organs of the body could be performed with success upon a suffering and struggling patient. The very muscular relaxation resulting from anesthesia is necessary to the success of many delicate and formidable operations. Thousands of operations are performed for the relief of suffering or the cure of disease which without an anesthetic would never be attempted.

Few at the present day realize the changes in surgical practice that have been wrought by anesthesia. Before its introduction into the Massachusetts General Hospital, but thirty-seven operations were performed per year. In the first five years after that event, operations averaged more than 100 in number. In 1900, in the same hospital, more than 3,700 operations were performed. It is not uncommon for a surgeon to perform 300 or 400 operations a year, and many prominent surgeons do more than this. This means the prolonging of many lives. Ovarian tumours, for example, commonly occur at or before middle life, and are fatal if not removed. Ovariotomy is an operation, however, which surgeons would hesitate to perform without an anesthetic, and few patients would submit to it. When Sir Spencer Wells reported his first series of 1,000 operations for ovariotomy, it was estimated

that he had added 20,000 years to the sum of human life.

As skill is largely the result of experience, this large yearly experience adds immensely to the skill of the operator, and consequently improves his results. It is undoubtedly true that never in the history of the world has the average technical skill of surgeons been so great as it is to-day. There are scores of surgeons to-day of not wide popular reputation who have actually greater technical skill than had some of the great celebrities of the past. In the older times a surgical operation was a remarkable event in a medical college, and the students gave up everything else to see it. Now they are an everyday occurrence.

The question of the discovery of the anesthetic power of sulphuric ether has been largely debated. The honour was claimed by four men, Morton of Massachusetts, Long of Georgia, Wells of Connecticut, and Jackson of Massachusetts. Each of these men have had their followers, but by quite universal consent the credit is awarded to Morton. Other discoveries visited America before Columbus, and other men knew of the anesthetic power of ether before Morton, but still the honour of discovery is no more justly given to the one than to the other. "While Long waited and Wells

turned back and Jackson was thinking," says Sir John Paget, "Morton, the practical man, went to work and worked resolutely." The discovery was made by him with but little knowledge of what the others had done, and the fortunate circumstance of residence in a large city enabled him to bring his discovery very quickly to the knowledge of the world. Whatever the claims of others may be, practically, the use of ether dates from October 16, 1846. In the Massachusetts General Hospital, in Boston, on that day, William T. G. Morton first used sulphuric ether as an anesthetic for a serious surgical operation.

The report of that event by an eye witness is most interesting. The test was to be made in the amphitheatre of the hospital, upon a patient of Doctor J. C. Warren. Much skepticism or actual unbelief in the discovery was felt, and those assembled looked only for failure. Doctor Morton was late, and when Doctor Warren remarked, "As Doctor Morton has not arrived, I presume he is otherwise engaged," there was a general smile of derision. Doctor Morton soon entered, however, and at once began his work. "Instructing his patient to breathe deep and long, and to have confidence in him, he skilfully piloted him into that profound state of ether narcotism we now

know so well. It was then that he said, 'Your patient is ready.' The first incision was made and there was no sign of suffering. A pin could have been heard to fall, so intense was the silence. Doctor Warren completed the operation and inserted the stitches. Still no sign of pain. The patient slumbered as peacefully as a child in happy dreams. Doctor Warren turned slowly from that recumbent figure. Looking up at those eager faces, he said quietly, 'Gentlemen, this is no humbug.' "

From that day the use of ether rapidly spread through the civilized world, and has steadily gained in favour. Although other anesthetics have been discovered and have been applied for special cases, the use of ether is still universal. As an efficient and safe anesthetic no rival has been found to supplant it.

The surgeon of sixty years ago would find much that is new in the modern hospital, and would be unable to account for the absence of many things with which he was familiar. The heavily padded doors of the operating room, which allowed no shriek of suffering to pass to the hospital beyond; the hooks in the floors and the ropes with which to bind down the struggling victim; the stalwart assistants to add their strength to that of the

ropes—all these things have disappeared forever. But the name of the man who wrought these changes is known to but one in a thousand. It is a strange commentary on the fickleness of fame.

In the year following Morton's demonstration in Boston, Sir James Y. Simpson, the great Edinburgh physician, demonstrated the anesthetic power of chloroform. It is true that chloroform had been discovered in this country sixteen years before, and had, perhaps, been used as an anesthetic, but to Simpson belongs all the credit for the real discovery of its anesthetic powers. Chloroform is a pleasanter anesthetic than ether. It takes effect and passes away more quickly, and is less liable to cause nausea. It is, however, variable in its action, and not as safe as ether for ordinary surgical cases. Except in certain selected cases, it is not largely used by surgeons in this country. In obstetrical cases there are special conditions present which render safe the use of chloroform. It is one of the greatest blessings given to suffering womanhood. When it can be received from the hands of a competent and careful physician, it need not be refused through fear. Queen Victoria was one of the first women to take chloroform during confinement, and her action did much to hasten its general adoption in such

cases. She did this at the request of Sir James Y. Simpson, who was her physician, one object in her mind being to popularize its use. She was also the first patient upon whom Lord Lister used an india rubber drainage tube. This was done in opening a small abscess of the axilla. It is a matter of passing interest that the term "anesthetic" was devised by Doctor Oliver Wendell Holmes, for many years the professor of anatomy in the Harvard Medical School.

The term "antisepsis" is commonly employed to designate the system of cleanliness designed to prevent the entrance of bacteria into wounds, abrasions, and sores. Lord Joseph Lister is the father of antiseptic surgery, and is still living. No definite date can be given, either for its discovery or announcement to the world, though the summer of 1876 is commonly considered the starting point. At that time, Lord Lister, then plain Doctor Lister, demonstrated certain methods of procedure before the International Medical Congress in session in Philadelphia. His ideas were quickly grasped by a few surgeons, particularly in America, and the system rapidly and steadily grew and expanded. So overwhelming was the evidence of its efficiency that it has been years since any surgeon dreamed of intentionally violating

its fundamental principles. The methods of Listerism, as the system was known in its earlier years, have been radically changed, and to the superficial observer there is little in common between it and modern asepsis. The fundamental underlying principles, however, are the same. Change has come as steadily increasing knowledge has shown better methods of securing the ends sought.

At first it was supposed that the bacteria of wound infections were derived chiefly from the air, and cumberous sprays were used over the site of operation. It was soon learned, however, that bacteria adhered to everything—the hands, instruments, sponges, and dressings. Nothing is free from them. Then came the prolonged washing of the hands with soap and antiseptics, and later the use of rubber gloves which have no crevices and creases for the lodging of bacteria. Instruments and dressings were sterilized by heat or antiseptics. The details have constantly changed, but the end sought has always been the same—the destruction or exclusion of germs. To-day greater attention is given to the exclusion of germs than formerly, and to this system is more properly applied the term "asepsis." It is better than antisepsis, which gives more thought to the

destruction of germs, because prevention is always better than cure. Antisepsis and asepsis, however, are closely combined, and are but part of the same system which seeks to keep wounds and sores free from living germs.

Surgery has lost much of its brilliancy and glitter since the days when a spectator stood with open watch and the operation was done with a dash and flourish. Showy operations like amputations are now comparatively less common than they formerly were. An operation to-day is a careful, painstaking procedure, hedged about with a multitude of commonplace and wearying details. Much of the dash and brilliancy is gone, for the operation is not finished until every portion of the offending growth has been dissected away, and the minute outlying glands have been searched for and removed one by one, and every bleeding point has been stopped. Important antiseptic details are carried out at every step, an error in any one of which will endanger the full success of the operation. These details seem to the onlooker intricate in the extreme. The reason for every one, however, is so obvious, and the surgeon is so trained to neglect none of them, that he forgets that they are intricate. The young medical man is, in fact, so trained to these methods, that he

forgets that there is any other way to perform an operation, and they become as a second nature.

A very few statistics showing the results of these methods will suffice to demonstrate that all this trouble is not taken in vain. Compound fracture, in which an end of the broken bone protrudes through the skin, was formerly one of the most dreaded of accidents. The old mortality was about 60 per cent., and amputation was often necessary among those who survived. The mortality now is a trifle more than 3 per cent., and amputation is rare. Compound fractures are still, however, accidents of serious import. The old mortality of major amputations was from 50 to 65 per cent.; it is now between 10 and 20 per cent. The old mortality of ovariotomy was also about 60 per cent. In 1862 a prominent surgeon said that the man who performed that operation should be indicted for manslaughter. Now a mortality of 3 per cent. is large for cases that are not cancerous. Many surgeons report series after series of 100 cases each without a death. The abdomen, a region formerly much feared by the surgeon, is now opened with the utmost safety. He seeks tumours here, as well as in the chest and skull, with little fear. In fact, the surgery of tumours, which includes not alone their removal, but a knowledge

of their nature and growth, has made particular progress. They are removed even though adherent to veins and arteries and important organs. In the neck, where the muscles, nerves, veins, and arteries are packed together more closely than in any other region of the body, the surgeon dissects out tumours in a way that is truly marvelous. He ties large and important arteries when they obstruct his path or when they feed growths whose removal is beyond his skill and daring. He removes whole sections of the bowel and unites their cut ends. He frequently removes a kidney, in olden times one of the most formidable operations of surgery, or cuts down and takes out a stone from its interior. He takes away impacted liver stones which would otherwise cause death—and takes bullets out of the brain and drains brain abscesses. These are among the common operations of modern surgery, and are not in the catalogue of rarer operations, like removal of the stomach and stitching of wounds in the heart.

The rate of mortality has been lowered in almost every surgical operation. A New York surgeon has recently reported 639 operations for hernia with one death. Many of these patients were young children, who are supposed to bear operations badly. In 1876, Doctor Gross referred to the

unusual fact that a certain surgeon had performed seven operations for goiter with but two deaths. In 1898, Kocker, of Berne, reported the removal of 556 goiters of non-cancerous nature with but one death. Macewen, of Glasgow, has recently reported 1,800 operations for deformed limbs on 704 patients, in which the bone was sawed or chiseled, with five deaths following. In three of these, pneumonia, scarlet fever, and diphtheria were contributing causes. Surgery for the correction of deformities has of late years been particularly satisfactory, and is virtually free from danger. In this branch of the art, American surgeons have been very successful. Some of the remarkable operations of recent years have been those performed upon the head, and have been made possible by a knowledge of "brain localization," which has become a science in itself. It has made ridiculous the old phrenology, the science of bumps on the exterior of the skull, and has not left it a solitary thread to hang by.

Abdominal surgery in its various forms is almost a new science. Peritonitis was a nightmare to the older surgeons, and well it might be. The peritoneum is the membrane which lines the abdominal wall, from which it is reflected onto the intestines and various organs. It covers nearly every

portion of these structures, and is therefore enormous in extent. It is smooth and shiny, and is designed to allow the various structures of the abdomen to play upon each other without friction. Inflammation roughens this smooth surface and irritates the nerves. The pain engendered by peritonitis is agony which must be felt to be comprehended. There are two other membranes in the body of similar type, known as serous membranes. These are the pleura in the chest, and the meninges in the skull. Pleurisy and meningitis are characterized by agonizing pain, as is peritonitis. These membranes are all very sensitive, particularly to bacterial infection. Inflammation once started from a local centre tends to spread rapidly and involve wide areas. No wonder, therefore, that the old surgeons feared the abdomen, the chest, and the head. One of the greatest triumphs of the modern surgeon is his ability to handle these membranes with virtually no danger of starting up an inflammation. In case of injury to the abdomen, as a bullet wound, he does not sit idly by, waiting for the peritonitis, and relieving the pain with opium, until the patient succumbs. He opens the abdomen, stitches up the wounds in the intestine, and washes out the intestinal contents which have leaked

through them into the peritoneal cavity. Sometimes, even when early operation is done, infection has already taken place by means of bacteria which have escaped through the intestinal wounds. In a large percentage of cases, however, peritonitis and other forms of infection are prevented and the patient is saved.

There are certain chronic ulcers of the stomach and intestines which tend to perforate into the peritoneum, thus causing a fatal form of peritonitis. Of 232 operations recently reported for this condition, 52 per cent. of the patients were saved. Perforated typhoid ulcers have thus been operated upon successfully. The combination of typhoid, perforation, and operation must, however, be so grave as to render recovery very uncertain.

Of all the surgical diseases of the abdomen, appendicitis has attracted the most popular attention. Perityphlitis, a collection of pus in the right side at the head of the large bowel, had long been known. Its danger was recognized, and the details of operation were well established. What was not known was that abscess in this region usually results from inflammation of the vermiform appendix, and also many cases of a very fatal form of peritonitis. It was not until 1888 that this fact was fully established by Fitz, of

Boston. Post-mortem examinations in patients dying from peritonitis had frequently shown the appendix inflamed or filled with pus, but this was supposed to have been secondary to the peritonitis. There was nothing to indicate that this apparently unimportant little organ could be the source of so much trouble. It was only as surgeons operated earlier and earlier, and tracked the inflammation down to its very starting point, that the truth was demonstrated. The appendix, it may be said, is a little tube-like body, closed at one end and opening at the other into the large bowel. It is simply a long, narrow, blind pouch.

Inflammation of the appendix is probably always the result of germ action. Seeds and other foreign bodies are found in about one case in twenty, but it is doubtful, even when they are present, whether they cause the inflammation. The appendix when inflamed readily becomes occluded at its attachment with the bowel, fills with pus, and ruptures. This usually allows the poisonous pus to enter the peritoneal cavity and at once set up an acute peritonitis. The inflammation sometimes extends directly to the peritoneum without any rupture. In rarer cases the tissues outside the peritoneum become involved, and an abscess is formed, which, as it increases in

size, may at any moment rupture into the abdomen. If the abscess is promptly opened recovery usually follows. This was the course pursued by the disease in the case of King Edward. His case was a typical one, and shows what every surgeon knows, that serious trouble may go on quietly for some days without giving urgent evidence of its presence. No skill can say just what course the disease may take in some cases. Sudden accidents are possible even when everything is apparently going well. This has led many surgeons to advise operation in every case, notwithstanding the fact that many cases recover without operation. This is no doubt extreme ground, but the medical man, who has seen patients die that he knows might have been saved by prompt operation, may be pardoned if he shows a disinclination to take risks. It is impossible to give any general rules which will be a safe guide for the patient himself in deciding this momentous question of operation. He must depend upon his physicians, who will decide the question after taking all the elements of his special case into consideration. If delayed until the patient is exhausted, or a vicious form of peritonitis has begun even slightly, the operation may be unavailing. It is then the disease, not the operation, which destroys the patient.

When there have been several attacks, there can be no question whatever as to the advisability of an "interval operation." Setting aside the possibility of a fatal result of some future attack, the relief of mind from the uncertainty and ever-present dread is usually worth what it costs.

Among the more recent aids to surgical science are local anesthesia and the Roentgen ray. The local anesthetics, cocaine and the more recent eucaine, fill wants that had long been felt. They are particularly useful in operations upon the eye and the various mucous membranes, by which they are rapidly absorbed. Surgery of the nasal passages is largely done by their aid. They do not penetrate the skin, and therefore must be administered by hypodermic injection in many localities. The rapid absorption of cocaine, thus taking it from the seat of operation and causing constitutional effects, is the chief cause of limiting its usefulness. It can be used with considerable freedom upon the extremities, as they can be bound by ligatures and the circulation temporarily stopped. Very recently cocaine has been injected into the lower part of the spinal cord with the effect of causing complete anesthesia of the lower portions of the body. Many extensive operations have thus been performed. The exact

advantages and limitations of this system of "spinal anesthesia" have not yet, however, been fully determined.

The discovery of the Roentgen ray has added greatly to the exactness of surgical diagnosis. The nature of many deformities, the location of bullets, foreign bodies, and deep-seated tumours, may often be determined with great certainty. It is now employed extensively, and its use is increasing. In many conditions its use requires great skill, and the interpretation of the pictures where numerous organs and tissues are involved demands large experience. They may prove very misleading to the inexperienced. Improvements in the apparatus are constantly being made, and skill in their use is steadily increasing. It was a marvelous discovery, and is destined to be an indispensable aid to surgery. As a curative measure in cancerous disease, and perhaps in tuberculosis, there is much evidence at hand to encourage hope. Its possibilities in these directions are being tested with great earnestness, and will be largely determined in the near future.

Military surgery is one of the branches of general surgery which has made great advancement. This was demonstrated in the Sudan campaign of Lord Kitchener, in which the medical and

surgical preparations were probably more perfect than in any other expedition in history, in the Cuban campaign, in South Africa, and the Philippines. In these recent campaigns, deaths from wounds have been extremely small, while the small number of amputations and major operations would have amazed the surgeons of the Civil War. The mortality from large-caliber wounds during the Civil War was 53.7 per cent. That of the Santiago campaign was 8 per cent., while that from small-caliber arms, which were unknown in the earlier war, was virtually nothing. This was partially due to training of the regular troops in proper methods of caring for their wounds themselves at the outset, and the carrying with them of "first-aid packages." These packages are simply antiseptic dressings, which are to be applied at the earliest possible moment after receiving a wound. Everything depends upon the first dressing and subsequent protection of the wound. Battle wounds at the outset are usually not septic, but become so by subsequent infection. The tropical heat of Cuba in July, the all-pervading moisture, the rank vegetation, and lack of shelter from the elements, combined to furnish ample opportunities for infection, with the resulting suppuration, blood poisoning, and gangrene. All

these were surprisingly rare. Had the general official management been as efficient as the immediate surgical treatment, the appalling death rate from typhoid and yellow fever would not have occurred, and the war would have been almost as famous for its small mortality in the army as it was in the navy.

The remarkable extension of railroads has developed a new department of surgery, that known as railroad surgery. Each important road maintains its surgical staff, who have to deal largely with peculiar and distinctive types of injury. The American Society of Railway Surgeons is a vigorous organization, which has added much to general surgery as well as to its own peculiar department.

The advances made in surgery during the past quarter of a century have been due largely to antiseptic methods. These methods were the direct result of the acceptance of the germ theory as the causation of surgical infection. Progress was more prompt and decided than in medicine because the conditions were more simple and easy of fulfilment. The surgeon knows that infection is liable to occur at a certain definite time, and can prepare beforehand to guard against it. He knows, moreover, that it is liable to occur in a cer-

tain definite place, and can protect that place, even though it be vulnerable for a long period of time. The physician, on the other hand, does not know in most cases when infection may occur, nor does he always know from what source or by what channel it may enter. The surgeon, being forewarned, can be forearmed, and can prevent infection. The physician is informed only after infection has taken place and the bacteria have already obtained a foothold and poisoned the patient. He is then called, not to prevent, but to counteract the results of infection the best he may. His task is a more difficult one than that presented to the surgeon when he is called early. The problem of preventive medicine is far more intricate and difficult than is the problem of preventive surgery. It was necessary for the physician to expend vast labour in studying infectious germs, learning their life history, the sources from which they are derived, the channels by which they enter the body, and the way in which they cause disease. For ten or fifteen years, therefore, surgery progressed much more rapidly than did medicine. During the past ten years, however, the more decided progress has been made by medicine. During the decade to come, it may be expected that this progress will continue. There

is still another reason for greater exactness in surgical practice than in medicine. The surgeon carries out his own advice and it is done skilfully and correctly. The instructions of the physician are carried out by others, and the results are often spoiled by ignorance or carelessness. "There would be more successful physicians," says Quimby, "if there were less foolish patients."

While improvement in surgical practice has resulted from steadily accumulating knowledge, as well as from increasing personal skill, the great advances of recent years have been due in chief measure to antiseptic and aseptic methods—that is, to preventive methods. In surgery, as in medicine, therefore, we find that the adage is as true now as it was of old, that prevention is better than cure.

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